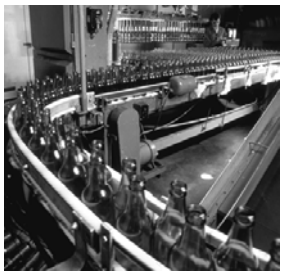
LISTEN.
THINK.
SOLVE.®

# PowerFlex® 700L Liquid-Cooled Adjustable Frequency AC Drive



**HARDWARE SERVICE MANUAL**

**Frame 2**

ALLEN-BRADLEY • ROCKWELL SOFTWARE

Rockwell Automation

## Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary we use notes to make you aware of safety considerations.

WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequences.

**Shock Hazard** labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.

**Burn Hazard** labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be at dangerous temperatures.

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# Summary of Changes

This is the first release of the *PowerFlex 700L Liquid-Cooled AC Drive Frame 2 Hardware Service Manual*.

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# Overview

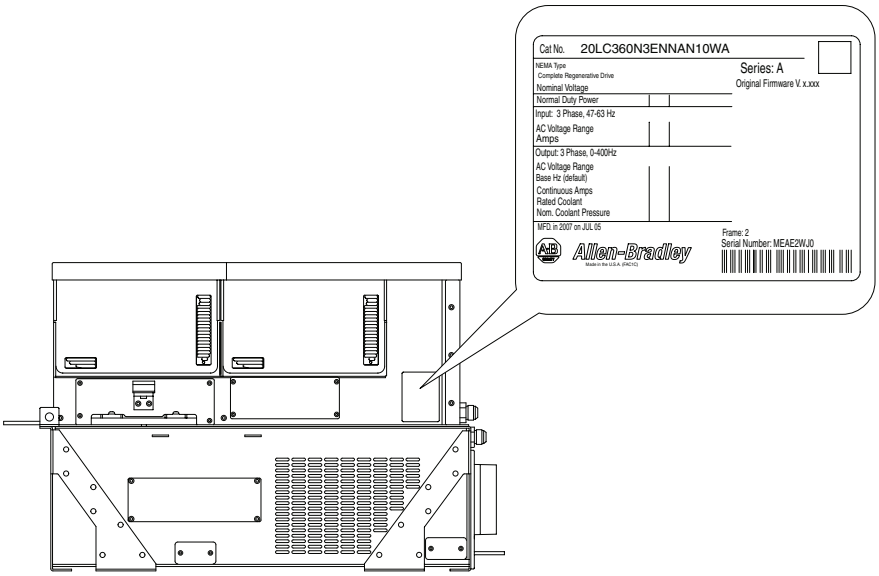
## Who Should Use this Manual?

This manual is intended for qualified service personnel responsible for troubleshooting and repairing PowerFlex 700L Liquid-Cooled Frame 2 Drives. You should have previous experience with, and basic understanding of, electrical terminology, procedures, required troubleshooting equipment, equipment protection procedures and methods, and safety precautions.

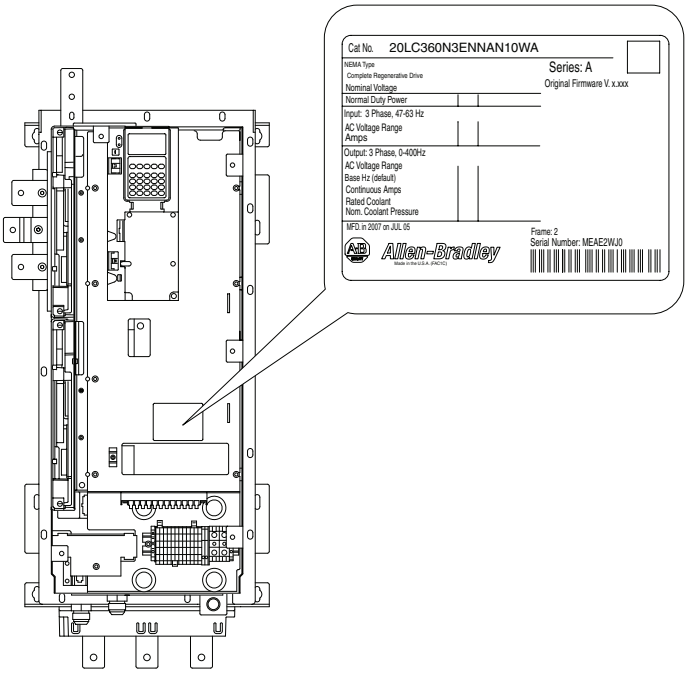
## What is in this Manual

This manual contains hardware service information for PowerFlex 700L Frame 2 drives only. Verify that you are working on a Frame 2 drive by checking the data nameplates on the inside of the bay doors and on the Power Modules. The frame number is printed just above the serial number. Figure P.1 shows the data nameplate locations.

**Figure P.1 PowerFlex 700L Frame 2 Drive Data Nameplate Locations**




**SIDE VIEW**




**FRONT VIEW (Cover Removed)**

## What is Not in this Manual

This manual does not contain in-depth fault information for troubleshooting. Depending on the control cassette installed in the drive, that information is available in the *PowerFlex 700 Adjustable Frequency AC Drive - Series B User Manual* (publication 20B-UM002) or the *PowerFlex 700S High Performance AC Drive - Phase II Control User Manual* (publication 20D-UM006). Additional information is also contained in the *PowerFlex 700L Liquid-Cooled Adjustable Frequency AC Drive User Manual* (publication 20L-UM001) and the *PowerFlex 700L Active Converter Power Module User Manual* (publication PFLEX-UM002).

## Reference Materials

You can view or download publications at www.rockwellautomation.com/literature. To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.

To find your local Rockwell Automation distributor or sales representative, visit www.rockwellautomation.com/locations.

The following publications provide general drive information.

| Title | Publication |
|---|---|
| Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives | DRIVES-IN001 |
| Safety Guidelines for the Application, Installation and Maintenance of Solid State Control | SGI-1.1 |
| A Global Reference Guide for Reading Schematic Diagrams | 0100-2.10 |
| Guarding Against Electrostatic Damage | 8000-4.5.2 |

The following publications provide specific PowerFlex drive information.

| Title | Publication |
|---|---|
| PowerFlex 700L Liquid-Cooled Adjustable Frequency AC Drive User Manual | 20L-UM001 |
| PowerFlex 700L Active Converter Power Module User Manual | PFLEX-UM002 |
| PowerFlex 700 Adjustable Frequency AC Drive User Manual - Series B | 20B-UM002 |
| PowerFlex 700S High Performance AC Drive - Phase II Control User Manual | 20D-UM006 |
| Hi-Resolution Feedback Option Card Installation Instructions for PowerFlex 700S Drives | 20D-IN001 |
| Multi-Device Interface Option Card Installation Instructions for PowerFlex 700S Drives | 20D-IN004 |
| PowerFlex Adjustable Frequency Drive Reference Manual (Volume 1 - 70 & 700) | PFLEX-RM001 |
| PowerFlex Adjustable Frequency Drive Reference Manual (Volume 2 - 700S) | PFLEX-RM002 |

The following publications provide information that is necessary when applying the DriveLogix Controller.

| Title | Publication |
|---|---|
| User Manual - DriveLogix System | 20D-UM002 |
| Installation Instructions - DriveLogix Controller | 20D-IN002 |
| Installation Instructions - Memory Expansion for DriveLogix Controller | 20D-IN007 |
| ControlNet Daughtercard Installation Instructions | 1788-IN002 |
| ControlNet Daughtercard Installation Instructions | 1788-IN005 |

## Understanding Manual Conventions

### Terms

The following words are used throughout the manual to describe an action:

| Word | Meaning |
|---|---|
| Can | Possible, able to do something |
| Cannot | Not possible, not able to do something |
| May | Permitted, allowed |
| Must | Unavoidable, you must do this |
| Shall | Required and necessary |
| Should | Recommended |
| Should Not | Not recommended |

### Cross References

"Figure 2.1 on page 2-2" is a hyperlinked cross reference to Figure 2.1 on page 2 of Chapter 2.

## Additional Support Available on Internet

Additional troubleshooting information and software tools are available on the Allen-Bradley Drives Support Web site: www.ab.com/support/abdrives

## General Precautions

### Class 1 LED Product

**ATTENTION:** Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into module ports or fiber-optic cable connectors.

**ATTENTION:** This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, refer to Allen-Bradley publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

**ATTENTION:** An incorrectly applied or installed drive can result in component damage or a reduction in product life. Wiring or application errors, such as undersizing the motor, incorrect or inadequate AC supply, or excessive ambient temperatures may result in malfunction of the system.

**ATTENTION:** Only **qualified personnel** familiar with PowerFlex 700L Drives and associated machinery should plan or implement the installation, start-up, and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

**ATTENTION:** To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged completely before servicing. After removing power to the drive, wait 5 minutes for the bus capacitors to discharge. With the cover of the drive removed, measure the DC bus voltage at the DC+ and DC- TESTPOINT sockets on the lower front of the power module (see Figure 2.2 on page 2-5 for details). The measured voltage must be zero (0).

**ATTENTION:** Potentially fatal voltages may result from improper usage of an oscilloscope and other test equipment. The oscilloscope chassis may be at a potentially fatal voltage if not properly grounded. If an oscilloscope is used to measure high voltage waveforms, use only a dual-channel oscilloscope in the differential mode with X 100 probes. It is recommended that the oscilloscope be used in the A minus B Quasi-differential mode with the oscilloscope chassis correctly grounded to an earth ground.

## Notes:

# Troubleshooting and Error Codes

**ATTENTION:** To avoid an electric shock hazard, ensure that all power to the drive has been removed before performing the following.

**ATTENTION:** To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged completely before servicing. After removing power to the drive, wait 5 minutes for the bus capacitors to discharge. With the cover of the drive removed, measure the DC bus voltage at the DC+ TESTPOINT and DC- TESTPOINT sockets on the lower front of the power module. The voltage must be zero.

**ATTENTION:** HOT surfaces can cause severe burns. **Do not** touch the heatsink surface during operation of the drive. After disconnecting power allow time for cooling.

**ATTENTION:** This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference Allen-Bradley publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

## Creating Fault Reports

Clear and complete fault reports are critical for analysis and repair of modules returned to the factory.

At a minimum, perform and record the following:

- Record the contents of the fault queue (faults and times of occurrence).
- Make record of any burn marks on the input inductor, filter capacitor assembly, precharge resistors, precharge contactors, printed circuit boards, bus bar, and cabling.
- Make record of any liquid or condensation marks on printed circuit boards, complete drive hose assemblies, and other mechanical parts.
- Make record of the amount of dust and other additional particles on drive and drive components.

- Make record of any mechanical damage to the drive and drive components.
- Record the size and type of main fuses.
- Record any other important marks and damages.

## Addressing Active Converter Hardware Faults

The following table describes active converter hardware faults.

| Fault | No. | Description | Action |
|---|---|---|---|
| HW Over Current | 1 | Control board detected excessive phase current. | Check cables and motor. Verify that the grounding tabs in the back of the control cassettes are making a solid connection. |
| HW Over Voltage | 2 | Control board detected excessive DC Link voltage. | Check input voltage. |
| HW Ground Fault | 3 | Control board detected a ground fault. | Check cables and motor. Verify that the grounding tabs in the back of the control cassettes are making a solid connection. |
| HW Disabled | 4 | Enable signal is not present. | Verify hardware enable is present. |
| HW Latch Error | 5 | Control board detected an unidentified fault. | Verify that the grounding tabs in the back of the control cassettes are making a solid connection. Contact Technical Support. |
| Precharge Open | 6 | The precharge contactor opened when it was commanded closed. | Verify operation of precharge contactor. |
| Precharge Closed | 7 | The precharge contactor closed when it was commanded open. | Verify operation of precharge contactor. |
| DPI Mastr ComLos | 8 | DPI communication with the inverter was lost. | Verify DPI cable installation. |
| Inverter Fault | 9 | Inverter detected a fault. | Examine inverter fault code. |
| PS1 Desat Phase R | 10 | Power structure 1 detected a desat fault on phase R. | Contact Technical Support. |
| PS1 Desat Phase S | 11 | Power structure 1 detected a desat fault on phase S. | Contact Technical Support. |
| PS1 Desat Phase T | 12 | Power structure 1 detected a desat fault on phase T. | Contact Technical Support. |
| PS1 Over Current | 13 | Power structure 1 detected excessive phase current. | Check motor, cables, and application for cause. |
| PS1 Over Voltage | 14 | Power structure 1 detected excessive DC Link voltage. | Check input power and application for cause. |
| PS1 Asym DC Link | 15 | Power structure 1 detected an asymmetrical DC Link voltage. | Verify load balance resistors. |
| PS1 Power Supply | 16 | Power structure 1 detected a power supply out of tolerance. | Replace power supply if problem persists. |
| PS1 HW Disable | 17 | Power structure 1 hardware enable is not present. | Verify drive enable is present. |
| PS1 Latch Error | 18 | Power structure 1 detected an unidentified fault. | Contact Technical Support. |
| PwrBd Incompat | 30 | Power board incompatible with control board. | Load new file into power board. |
| PB Ver Corrupted | 31 | Power board version number is corrupted. | Load new file into power board. |

| Fault | No. | Description | Action |
|---|---|---|---|
| Default Corrupted | 32 | Power board default data file is corrupted. | Load new file into power board. |
| Rating Corrupted | 33 | Power board rating data file is corrupted. | Load new file into power board. |
| New ControlBoard | 34 | New converter control board was detected. | Reset to defaults is required. |
| Elapsed Checksum | 35 | Elapsed operation checksum is invalid at power up. | Reset to defaults is required. |
| Param Checksum | 36 | Parameter data checksum is invalid at power up. | Reset to defaults is required. |
| Param Checksum B | 37 | Parameter data checksum error when writing a BYTE value. | Reset to defaults is required. |
| Param Checksum W | 38 | Parameter data checksum error when writing a WORD value. | Reset to defaults is required. |
| Param Checksum L | 39 | Parameter data checksum error when writing a LONG value. | Reset to defaults is required. |
| Ac Line Lost | 40 | AC line synchronization was lost when power turned off. | Verify proper input line voltage is present. |
| Ac Phase Lost | 41 | AC line synchronization was lost when when a phase was lost. | Verify proper input line voltage is present. |
| Ac Sync Low Vac | 42 | AC line synchronization was lost because voltage was low. | Verify proper input line voltage is present. |
| AC Sync Low Freq | 43 | AC line synchronization was lost because frequency was low. | Verify proper input line voltage is present. |
| AC Sync High Freq | 44 | AC line synchronization was lost because frequency was high. | Verify proper input line voltage is present. |
| AC Sync Conflict | 45 | Conflict in AC line synchronization state machine. | Contact Technical Support. |
| PWM Sync Lost | 46 | PWM Carrier synchronization was lost. | Verify wiring of carrier synchronization twisted pair. |
| Ac Low Voltage | 50 | AC line voltage was below the configured limit for the configured time. | Verify proper input line voltage is present. |
| Ac High Voltage | 51 | AC line voltage exceeded the configured limit for the configured time. | Verify proper input line voltage is present. |
| Ac Low Frequency | 52 | AC line frequency was below the configured limit for the configured time. | Verify proper input line voltage is present. |
| Ac High Frequency | 53 | AC line frequency exceeded the configured limit for the configured time. | Verify proper input line voltage is present. |
| Ac High dFdT | 54 | Change in line frequecy exceeded the configured limit. | Verify proper input line voltage is present. |
| Ac I Imbalance | 55 | AC current balance exceeded the configured limit for the configured time. | Verify proper input line voltage is present. |
| Ac V Imbalance | 56 | AC voltage balance exceeded the configured limit for the configured time. | Verify proper input line voltage is present. |
| DcLink Low Volt | 57 | DC link voltage was below the precharge open level. | Verify proper input line voltage is present. |
| Ride Thru Expire | 58 | Power dip ride through expired with the precharge open. | Verify proper input line voltage is present. |
| Ride Thru Expire | 59 | Power dip ride through expired with the precharge closed. | Verify proper input line voltage is present. |
| IT Over Load | 60 | Operating current levels exceeded the rated overload. | Verify application operates within limits. |
| Ambnt Over Temp | 61 | Measured ambient temperature exceeded the maximum limit. | Take steps to lower ambient. |

| Fault | No. | Description | Action |
|---|---|---|---|
| Base Over Temp | 62 | IGBT base temperatures exceeded the maximum limit. | Verify the required drive cooling is present. |
| Jnct Over Temp | 63 | IGBT junction temperature exceeded the maximum limit. | Verify drive cooling and excessive current levels. |
| Ntc Range Low | 64 | NTC temperature below rated temperature range. | Check for open or shorted NTC device. |
| Ntc Range High | 65 | NTC temperature above rated temperature range. | Check for open or shorted NTC device. |
| PS1 Fan Loss | 66 | Power structure 1 detected a circulating fan was lost. | Verify internal circulating fans are turning. |
| PS1 Reactor Temp | 67 | Power structure 1 detected the reactor thermal switch opened. | Verify reactor cooling fans are turning. |

For additional information regarding the active converter, please refer to the *PowerFlex 700 Active Converter Power Module User Manual* (publication PFLEX-UM002).

## Addressing 700 Vector Control Hardware Faults

The following table describes two groups of 700 Vector Control faults. The first group contains faults common to both the 20B and 20L products. The second group contains faults existing only in the 20L product.

| Fault | No. | Description | Action |
|---|---|---|---|
| | | Faults Common to 20B and 20L Products | |
| Auxiliary Input | 2 | Auxiliary input interlock is open. | Check remote wiring. |
| Power Loss | 3 | DC bus voltage remained below 85% of nominal longer than [Power Loss Time]. | Monitor input voltage for low voltage or line power interruptions. |
| Under Voltage | 4 | DC bus level fell below minimum value. | Monitor input voltage for low voltage or line power interruptions. |
| Over Voltage | 5 | DC bus level exceeded maximum value. | Monitor input voltage for high line or transient voltage. |
| Motor Overload | 7 | Internal electronic overload trip. | Reduce load so drive output current does not exceed the current set by [Motor NP FLA]. |
| Heatsink OvrTemp | 8 | Heatsink temperature exceeded 100% of [Drive Temp]. | Check water loop.<br>Check for excess load. |
| Trnsistr OvrTemp | 9 | Output transistors have exceeded their maximum operating limit. | Check water loop.<br>Check for excess load. |
| HW OverCurrent | 12 | The drive output current has exceeded the hardware current limit. | Check programming. Check for excess load, improper DC boost or other causes of excess load.<br>Verify that the grounding tabs in the back of the control cassettes are making a solid connection. |
| Ground Fault | 13 | A current path to ground greater than 25% of drive rating exists. | Check motor and external wiring to drive output terminals for a grounded condition.<br>Verify that the grounding tabs in the back of the control cassettes are making a solid connection. |
| Load Loss | 15 | Drive output current is below [Load Loss Level] for a time greater than [Load Loss Time]. | Verify the connections between motor and load. Verify level and time. |

| Fault | No. | Description | Action |
|---|---|---|---|
| Motor Thermistor | 16 | Thermistor output is out of range. | Verify the thermistor is connected. Motor is overheated. Reduce load. |
| Output Phase Loss | 21 | Current in one or more of the phases has been lost or is below a preset level. | Check the drive and motor wiring. |
| Phase U to Grnd | 38 | A phase to ground short has been detected between the drive and the motor in this phase. | Check the wiring between the drive and the motor. Check motor for ground. Replace power module. |
| Phase V to Grnd | 39 | | |
| Phase W to Grnd | 40 | | |
| Phase UV Short | 41 | Excessive current has been detected between these two output terminals. | Check the motor and the drive output terminal wiring for a shorted condition. Replace power module. |
| Phase VW Short | 42 | | |
| Phase UW Short | 43 | | |
| Drive Overload | 64 | Drive rating of 110% for 1 minute or 150% for 3 seconds has been exceeded. | Reduce load. |
| Port 1-6 Adapter | 71-76 | Communications adapter on port reported a fault. | Check communication cable and check adapter fault queue for information about the fault. |
| Port 1-6 DPI Fault | 81-86 | DPI communications to port was lost. | If adapter was not intentionally disconnected, check wiring. Replace wiring, port expander, or Main Control Board as needed. Check HIM connection. |
| Faults Existing Only in 20L Products | | | |
| 700L Dsat U | 170 | Phase U Desat fault on 700L power structure. | Contact Technical Support. |
| 700L Dsat V | 171 | Phase V Desat fault on 700L power structure. | Contact Technical Support. |
| 700L Dsat W | 172 | Phase W Desat fault on 700L power structure. | Contact Technical Support. |
| 700L OvrCurnt | 173 | Over current on 700L power structure. | Check programming. Check for cause of excessive current. |
| 700L OvrVolt | 174 | Over voltage on 700L power structure. | Check programming. Check for cause of excessive voltage. |
| 700L Asym Vdc | 175 | Asymmetrical voltage on 700L power structure DC link. | Verify load balance resistors. |
| 700L PwrSply | 176 | Power supply failed on 700L power structure. | Replace power supply if problem persists. |
| 700L HW Disable1 | 177 | Hardware disable asserted on 700L power structure. | Verify drive enable is present. |
| 700L Latch Err | 178 | Fault reporting failure on 700L power structure. | Verify that the grounding tabs in the back of the control cassettes are making a solid connection.<br>Contact Technical Support. |
| 700L Fan Loss | 179 | Fan failure on 700L power structure. | Verify internal circulating fans are turning. |
| Cnv NotLogin | 190 | Active converter did not begin communication. | Check DPI connection. Check for proper versions. |
| Cnv Not Start | 191 | Active converter did not start when requested. | Check start inhibits. Check parameter 214 - [Start Inhibit]. |
| 700L NTC Open | 192 | Thermal sensor failed on 700L power structure. | Contact Technical Support. |

For additional information regarding 700 Vector Control, please refer to the *PowerFlex 700 Adjustable Frequency AC Drive User Manual - Series B* (publication 20B-UM002).

## Addressing 700S Phase II Control Hardware Faults

The following table describes two groups of 700S Phase II faults. The first group contains faults common to both the 20D and 20L products. The second group contains faults existing only in the 20L product.

| Name | No. | Description | Action |
|---|---|---|---|
| Faults Common to 20D and 20L Products | | | |
| Motor OLoad Trip | 11 | Internal electronic overload trip. | Reduce load so drive output current does not exceed the current set by [Motor NP FLA]. |
| Inv OTemp Trip | 15 | P313 [Heatsink Temp] is above the maximum limit. | Reduce the mechanical load. Check cooling loop. |
| Inv OLoad Trip | 17 | The drive's operating point has exceeded the intermittent current rating and a foldback to the continuous rating has occurred. | Reduce the mechanical load configured with P377 [Inv OL Trip Cnfg]. |
| DC Bus OverVolt | 24 | An over voltage has occurred on the DC bus. | Check programming. Check for cause of excessive voltage. |
| Ground Fault | 26 | A current to earth exceeds 35% of the peak drive rating. | Check the motor and external wiring to the drive output terminal for a grounded condition.<br>Verify that the grounding tabs in the back of the control cassettes are making a solid connection. |
| DC Bus Undervolt | 42 | Bus voltage has fallen below the level configured by P409 [Line Undervolts]. | Monitor input voltage for low voltage. |
| DPI Loss Port 1-6 | 49-54 | The device at DPI Port 1-6 has stopped communicating. | Verify the DPI device is present and functional at the port. |
| Net Loss DPI 1-6 | 55-60 | A communication fault has occurred between the adapter at port 1-6. | Verify network connection. Verify status of network. |
| Faults Existing Only in 20L Products | | | |
| 700L Dsat U1 | 97 | Phase U Desat fault on 700L power structure 1. | Contact Technical Support. |
| 700L Dsat V1 | 98 | Phase V Desat fault on 700L power structure 1. | Contact Technical Support. |
| 700L Dsat W1 | 99 | Phase W Desat fault on 700L power structure 1. | Contact Technical Support. |
| 700L OvrCurnt1 | 100 | Over current on 700L power structure 1. | Check programming. Check for cause of excessive current.<br>Verify that the grounding tabs in the back of the control cassettes are making a solid connection. |
| 700L OvrVolt1 | 101 | Over voltage on 700L power structure 1. | Check programming. Check for cause of excessive voltage. |
| 700L AsymDcLink1 | 102 | Asymmetrical voltage on 700L power structure 1 DC link. | Verify load balance resistors. |
| 700L PwrSply1 | 103 | Power supply failed on 700L power structure 1. | Replace power supply if problem persists. |
| 700L HW Disable1 | 104 | Hardware disable asserted on 700L power structure 1. | Verify drive enable is present. |
| 700L Latch Err 1 | 105 | Fault reporting failure on 700L power structure 1. | Verify that the grounding tabs in the back of the control cassettes are making a solid connection.<br>Contact Technical Support. |
| 700L Fan Fail 1 | 106 | Fan failure on 700L power structure 1. | Verify internal circulating fans are turning. |
| 700L Cnv Faulted | 110 | Active converter has faulted. | Check active converter fault log. |

| Name | No. | Description | Action |
|---|---|---|---|
| Cnv NotLogin | 111 | Active converter did not begin communication. | Check DPI connection. Check for proper versions. |
| Cnv Not Start | 112 | Active converter did not start when requested. | Check start inhibits. Check parameter 214 [Start Inhibits]. |

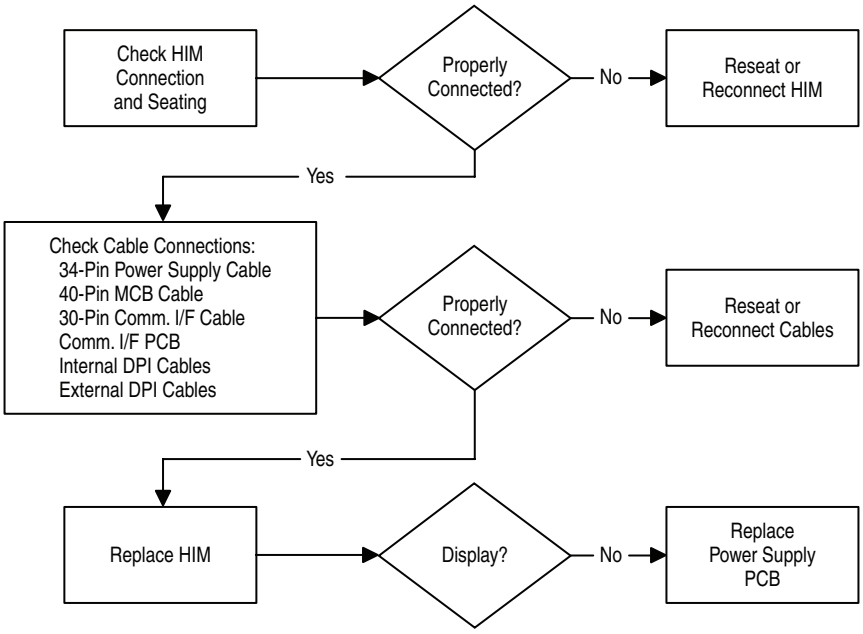
For additional information regarding 700S Phase II Control, please refer to the *PowerFlex 700S High Performance AC Drive - Phase II User Manual* (publication 20D-UM006).

## Diagnostic Procedures by Symptom

The following charts list drive symptom, symptom descriptions, and recommended actions.

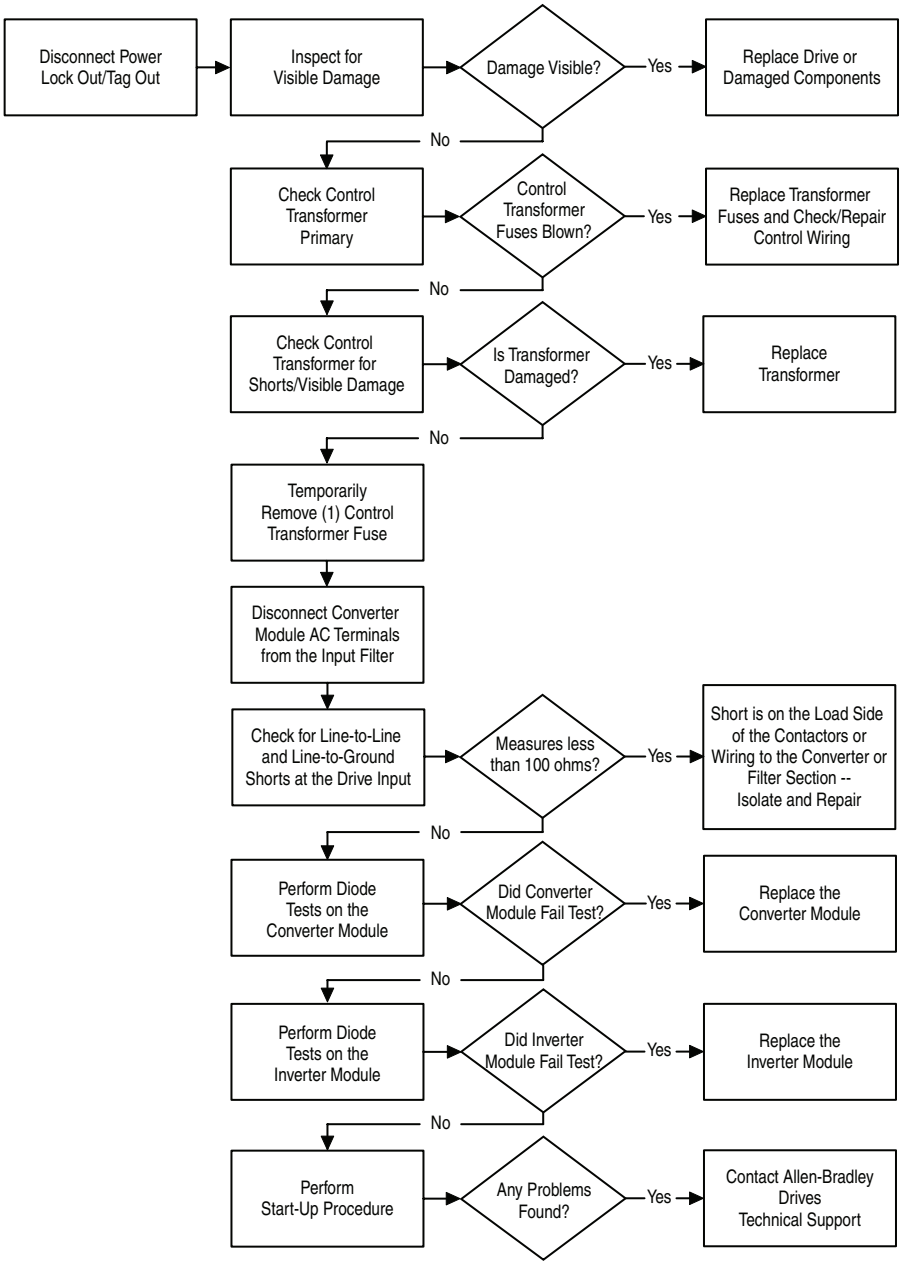
### No HIM Display

Use this procedure when the HIM does not function:



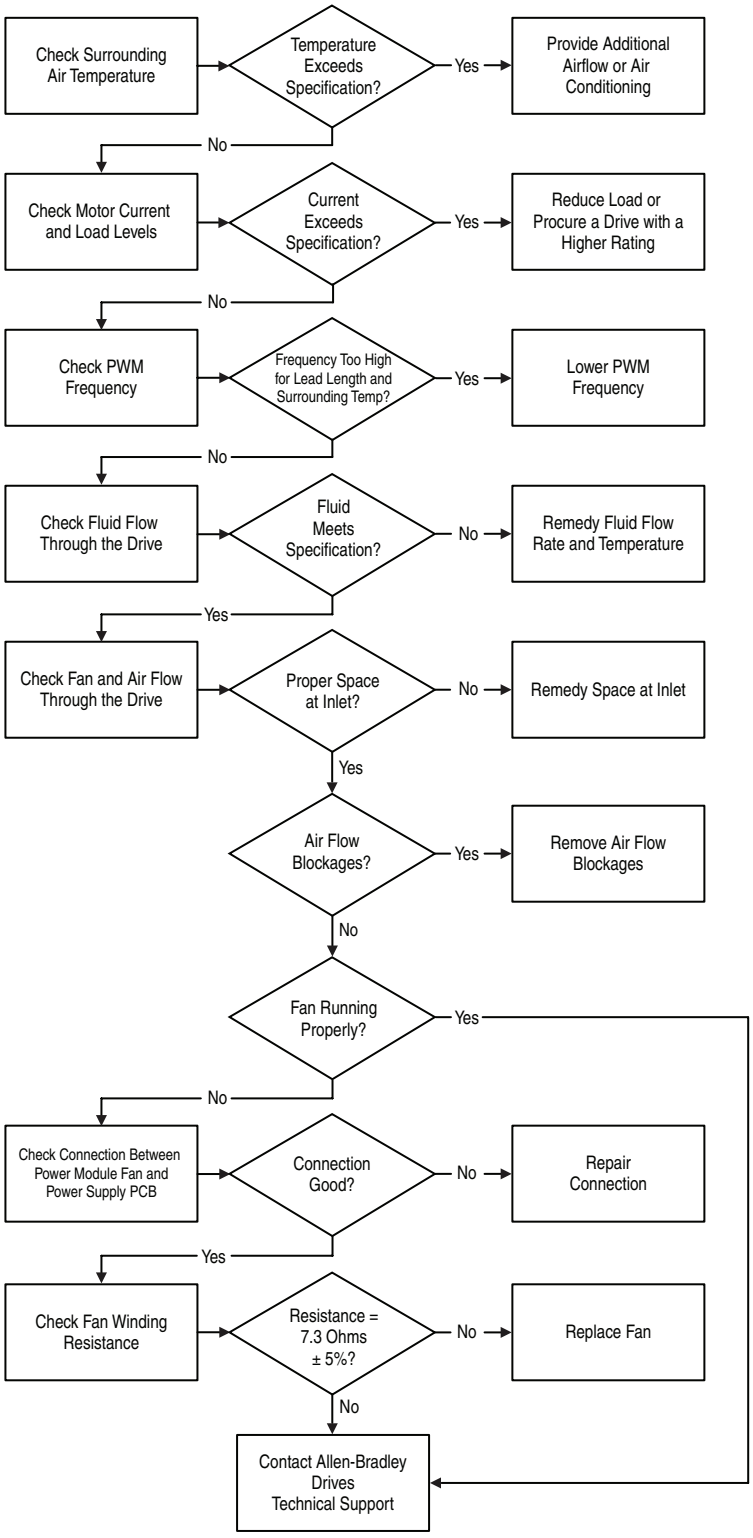
## Circuit Breaker Tripped – Blown Input Fuses

Use this procedure when a drive clears any of its circuit breaker or power fuses (branch circuit protection):



## Over-Temperature Faults

Use this procedure to troubleshoot drive over-temperature faults:



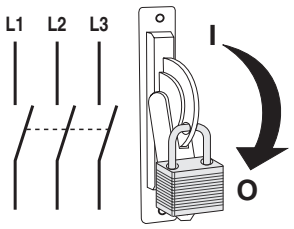
## Notes:

# Component Test Procedures

**ATTENTION:** To avoid an electric shock hazard, ensure that all power to the drive has been removed before performing the following.

**ATTENTION:** To avoid an electric shock hazard, verify that the voltage on the Power Module DC bus capacitors has discharged completely before performing any work on the drive.

1. Turn off and lock out input power. Wait 5 minutes.




2. With the cover of the drive removed, measure the DC bus voltage at the DC+ and DC- TESTPOINT sockets on the lower front of the power module (see Figure 2.2 on page 2-5 for details). The measured voltage must be zero (0).

**ATTENTION:** HOT surfaces can cause severe burns. **Do not** touch the heatsink surface during operation of the drive. After disconnecting power allow time for cooling.

**ATTENTION:** This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, refer to Allen-Bradley publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

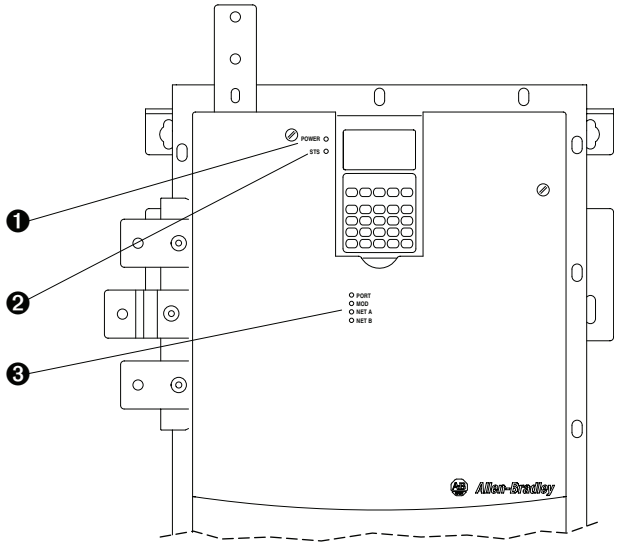
## Drive Status

The condition or state of your 700L drive is constantly monitored. Any changes will be indicated through the HIM option (if present) and/or four sets of status indicators:

- Power Module status indicators (for both 700S and 700 vector control).
- SynchLink option indicators (for 700S control only).
- DriveLogix communications option indicators (for 700S control only).
- Network communication adapter option indicators (if installed).

The drive status indicators are located on the top front of the drive.

**Figure 2.1 Drive Status Indicators**




## Viewing the PowerFlex 700 Vector Control Diagnostic Indicators

The PowerFlex 700L power module contains Power and Status indicators and, if installed, Communication Adapter indicators (Figure 2.1). These indicators are only operational when the drive is energized.

**ATTENTION:** The indicators are only operational when the drive is energized. Servicing energized equipment can be hazardous. Severe injury or death can result from electrical shock, burn or unintended actuation of controlled equipment. Follow Safety related practices of NFPA 70E, ELECTRICAL SAFETY FOR EMPLOYEE WORKPLACES. DO NOT work alone on energized equipment!

### Status Indicators

| Item | Name | Color | State | Description |
|---|---|---|---|---|
| ❶ | POWER | Green | Steady | Illuminates when power is applied to the drive. |
| ❷ | STS (Status) | Green | Flashing | Drive ready, but not running and no faults are present. |
| | | | Steady | Drive running, no faults are present. |
| | | Yellow | Flashing, Drive Stopped | A type 2 alarm condition exists, the drive cannot be started. Check parameter 211 [Drive Alarm 2]. |
| | | | Flashing, Drive Running | An intermittent type 1 alarm condition is occurring. Check parameter 211 [Drive Alarm 1]. |
| | | | Steady, Drive Running | A continuous type 1 alarm condition exists. Check parameter 211 [Drive Alarm 1]. |
| | | Red | Flashing | Fault has occurred. Check [Fault x Code] or Fault Queue. |
| | | | Steady | A non-resettable fault has occurred. |
| ❸ | PORT | Refer to the *Communication Adapter User Manual.* | | Status of DPI port internal communications (if present). |
| | MOD | | | Status of communications module (when installed). |
| | NET A | | | Status of network (if connected). |
| | NET B | | | Status of secondary network (if connected). |

## Viewing the PowerFlex 700S Control Diagnostic Indicators

In addition to the PowerFlex 700L power module indicators (Figure 2.1), the 700S control cassette contains Run, controller, and SynchLink indicators. These indicators are only operational when the drive is energized and only visible when the drive door is open. The status of these indicators can also be viewed from the HIM or from an applications program (for example, DriveExplorer) in parameter 554 (LED Status). This feature is only available with PowerFlex 700S Phase II control version 3.001 or later.

**ATTENTION:** The Run and controller indicators are only operational when the drive is energized. Servicing energized equipment can be hazardous. Severe injury or death can result from electrical shock, burn or unintended actuation of controlled equipment. Follow Safety related practices of NFPA 70E, ELECTRICAL SAFETY FOR EMPLOYEE WORKPLACES. DO NOT work alone on energized equipment!

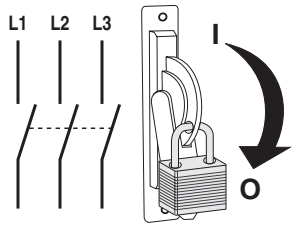
### Status Indicators

| | | | Item | Name | Color | State | Description |
|---|---|---|---|---|---|---|---|
| DRIVE | Power Structure | | ❶ | PWR (Power) | Green | Steady | Illuminates when power is applied to the drive. |
| | | | ❷ | STS (Status) | Green | Flashing | Drive ready, but not running & no faults are present. |
| | | | | | | Steady | Drive running, no faults are present. |
| | | | | | Yellow | Flashing | When running, a type 2 (non-configurable) alarm condition exists, drive continues to run. When stopped, a start inhibit exists and the drive cannot be started. |
| | | | | | | Steady | A type 1 (user configurable) alarm condition exists, but drive continues to run. |
| | | | | | Red | Flashing | A fault has occurred. |
| | | | | | | Steady | A non-resettable fault has occurred. |
| | | | | | Red / Yellow | Flashing Alternately | The drive is in flash recovery mode. The only operation permitted is flash upgrade. |
| | Control Assembly | Communications | ❸ | PORT | Refer to the *Communication Adapter User Manual* | | Status of DPI port internal communications (if present). |
| | | | | MOD | | | Status of communications module (when installed). |
| | | | | NET A | | | Status of network (if connected). |
| | | | | NET B | | | Status of secondary network (if connected). |
| | | Control | (1) | SYNCHLINK | Green | Steady | The module is configured as the time keeper. – or – The module is configured as a follower and synchronization is complete. |
| | | | | | Green | Flashing | The follower(s) are not synchronized with the time keeper. |
| | | | | | Red | Flashing | The module is configured as a time master on SynchLink and has received time information from another time master on SynchLink. |
| | | | | ENABLE | Green | On | The drive's enable input is high. |
| | | | | | Green | Off | The drive's enable input is low. |

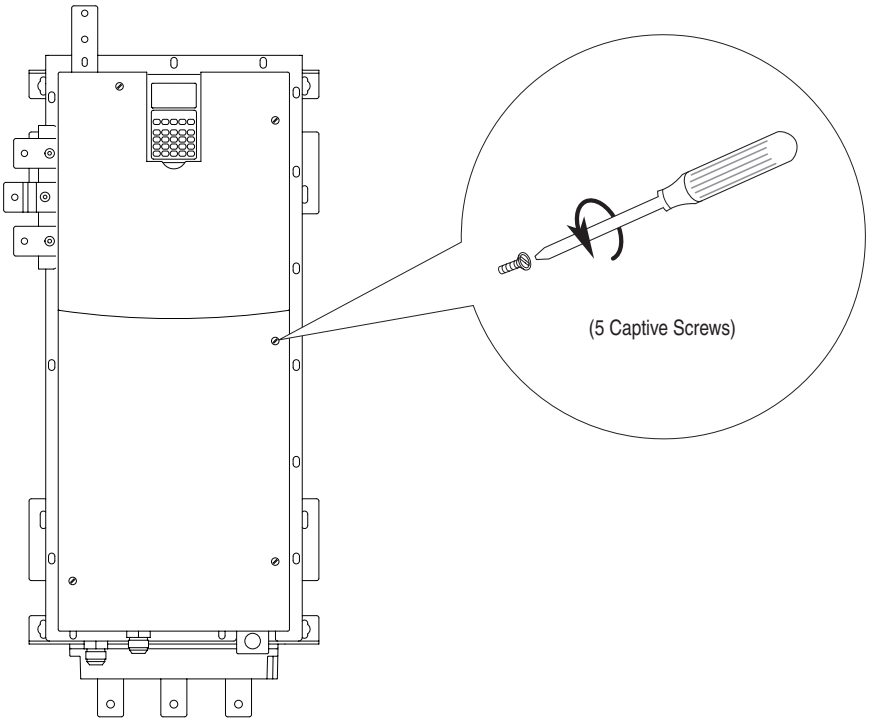
(1) SynchLink LEDs are located on the SynchLink daughtercard on the main circuit board in the control cassette.

## Removing Power from the Drive

1. Turn off and lock out input power. Wait five (5) minutes.

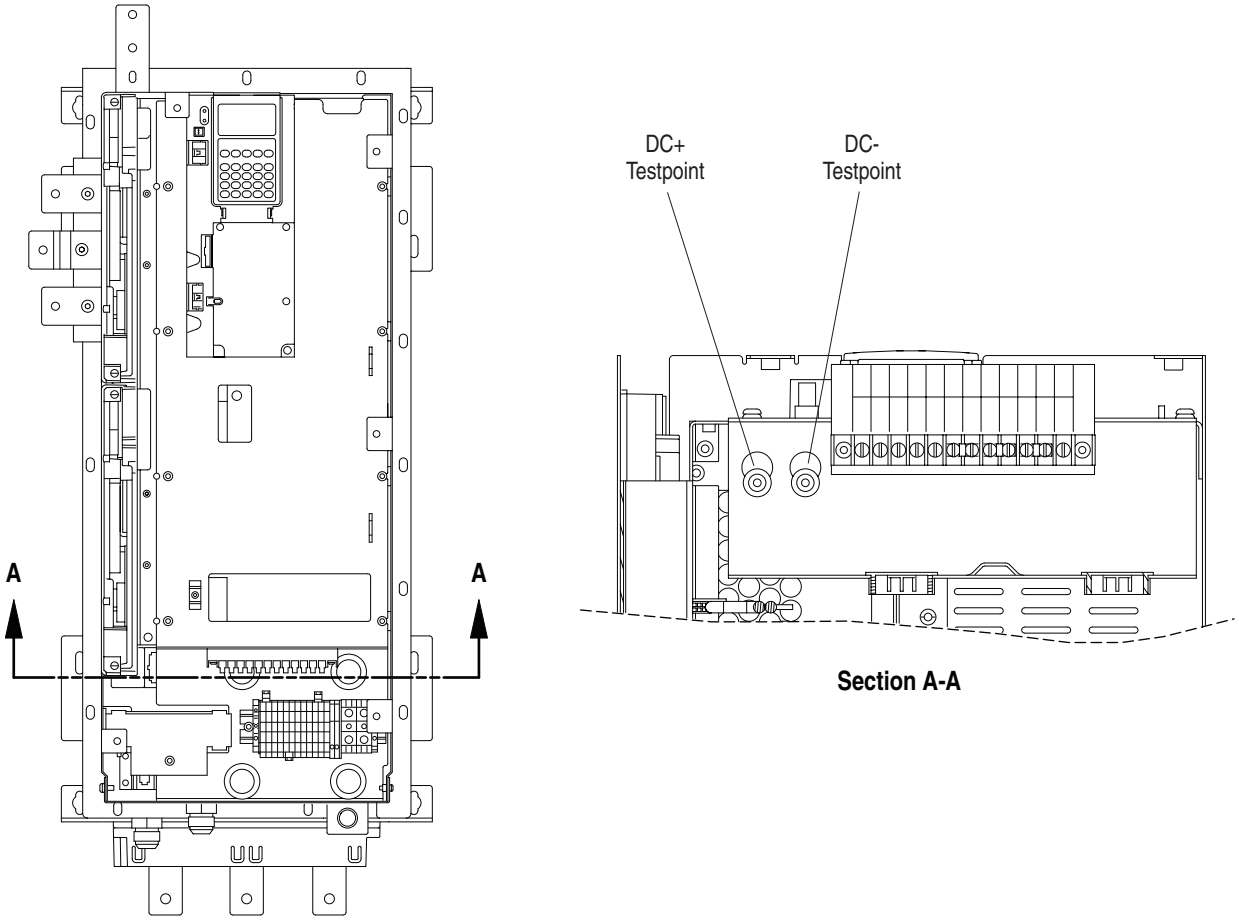



2. Remove and save the drive cover (see Removing the Drive Front Cover on page 3-4).




3. Check for zero (0) volts between the DC+ and DC- testpoints. Using 4 mm (0.158 in.) socket probes, connect the voltmeter to DC+ and DC- TESTPOINT sockets on the lower front of the power module. The measured voltage must be zero (0).

**Figure 2.2 Measuring the DC Bus Voltage at the DC Testpoint Sockets**




## Periodic Inspections with No Power Applied

### Coolant Hoses/Connections

Visually inspect the inlet and outlet coolant hose assemblies, and filter section-to-power section coolant connections for leaks. Replace hoses if leaks cannot be stopped.

### Terminal Bolts, Mounting Bolts, etc.

Ensure all power conductor terminal bolts and mounting bolts are tight. Tighten loose bolts. Refer to Chapter 3 for torque specifications.

## Periodic Inspections with Power Applied

### Checking the Power Module Fan

Check for vibration and noise. Fan failure may be imminent if vibration and/or increasing noise in the fan bearings occurs. Fan replacement is recommended at this time. Refer to Removing the Power Section Stirring Fan on page 3-9.

## Checking the Input Filter Fans

The Frame 2 input filter has two fans just above the input terminals of the drive.

**ATTENTION:** Fans are only operational when the drive is energized and only visible with cabinet doors open. Servicing energized equipment can be hazardous. Severe injury or death can result from electrical shock, burn or unintended actuation of controlled equipment. Follow safety-related practices of NFPA 70E, ELECTRICAL SAFETY FOR EMPLOYEE WORKPLACES. DO NOT work alone on energized equipment!

Check for vibration and noise. Fan failure may be imminent if vibration and/or increasing noise in the fan bearings occurs. Fan replacement is recommended at this time.

## Forward Biased Diode Tests for the Power Module

A forward biased diode test checks the semiconductor junctions between the terminals and measures the voltage drop across those junctions. To run the test, use a digital multi-meter with a diode check mode. To pass each test, the meter must display a voltage within the specification shown in the table. If the test finds a short, the meter will display ".000." If the test finds an open circuit or reversed polarity, the meter will display ".0L."

1. Remove power from the drive (see Removing Power from the Drive on page 2-4).
2. Disconnect power conductors from R/L1, S/L2, T/L3, U/T1, V/T2, and W/T3 terminals on the power module. For power module terminal names and locations, refer to Figure 2.1 or Figure 2.11 in the *PowerFlex 700L User Manual*.
3. Perform forward biased diode tests on the points listed in Table 2.A. If the power module fails any of these tests, then replace the power module.

**Table 2.A Forward Biased Diode Tests for the Power Module**

| Meter Leads | | |
|---|---|---|
| + | - | Nominal Meter Reading |
| DC+ | DC- | Value should gradually rise to 0.75V or greater. |
| R/L1 | DC+ | 0.30…0.40V |
| S/L2 | DC+ | |
| T/L3 | DC+ | |
| DC- | R/L1 | |
| DC- | S/L2 | |
| DC- | T/L3 | |
| U/T1 | DC+ | |
| V/T2 | DC+ | |
| W/T3 | DC+ | |
| DC- | U/T1 | |
| DC- | V/T2 | |
| DC- | W/T3 | |

# Access Procedures

**ATTENTION:** To avoid an electric shock hazard, ensure that all power to the drive has been removed before performing the following.

**ATTENTION:** To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged completely before servicing. Measure the DC bus voltage at the DC+ and DC- TESTPOINT sockets on the lower front of the power module. The measured voltage must be zero (0).

**ATTENTION:** The sheet metal cover and mounting screws on the ASIC Board located on the power structure are energized at (-) DC bus potential high voltage. Risk of electrical shock, injury, or death exists if someone comes into contact with the assembly.

**ATTENTION:** HOT surfaces can cause severe burns. **Do not** touch the heatsink surface during operation of the drive. After disconnecting power allow time for cooling.

**ATTENTION:** Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.

**ATTENTION:** This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference Allen-Bradley publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

## Torque Specifications

The following table lists fastener torque specifications for the Frame 2 complete drive spare parts kits:

| Kit Catalog Number | Description | Fastener | Torque Final |
|---|---|---|---|
| SK-L1-CVR1-F2 | Front Cover | Slotted captive screw | 3.1 N•m (27 lb•in) |
| 20L-VECTB-C0 | Inverter Vector Control Cassette, 24V | Slotted captive screw | 0.6 N•m (5 lb•in) |
| 20L-VECTB-D0 | Inverter Vector Control Cassette, 115V | | |
| 20D-P2-CKE1 | Inverter 700S Phase II Control Cassette | | |
| 20D-DL2-CKE1 | Inverter 700S Phase II Control Cassette with DriveLogix 5730 | | |
| SK-L1-ACC1-F3D | Active Converter Control Cassette, 400/480V | | |
| SK-L1-ACC1-F3F | Active Converter Control Cassette, 600/690V | | |
| SK-L1-FAN2-F2 | Power Section Stirring Fan | M5 x 10 mm Torx screw | 3.2 N•m (28 lb•in) |
| SK-L1-PIABI1-F2 | Inverter Power Interface PCB | M5 x 10 mm Torx screw<br>M4 x 10 mm Torx screw | 3.2 N•m (28 lb•in)<br>1.7 N•m (15 lb•in) |
| SK-L1-PIAC1-F3 | Converter Power Interface PCB | | |
| SK-L1-PWRS1-F2 | PCB Power Supply | M5 x 10 mm Torx screw<br>M4 x 10 mm Torx screw | 3.2 N•m (28 lb•in)<br>1.7 N•m (15 lb•in) |
| SK-L1-PWRS2-F2 | Input Filter Fan Power Supply | M5 x 10 mm Torx screw<br>M4 x 10 mm Torx screw | 3.2 N•m (28 lb•in)<br>1.7 N•m (15 lb•in) |
| SK-L1-FUSE1-F2 | Control Transformer Fuses | M5 x 10 mm Torx screw | 3.2 N•m (28 lb•in) |
| SK-L1-XFMR1-F2 | Control Transformer, 200VA | | |
| SK-L1-FAN1-F2 | Input Filter Fan Assembly | M4 x 20 mm Torx screw | 1.7 N•m (15 lb•in) |
| SK-L1-HPWRS1-F2 | J1-to-J6 Power Interface Harness | M5 x 10 mm Torx screw | 3.2 N•m (28 lb•in) |
| SK-L1-HPWRS2-F2 | J3-to-J4 Power Interface Harness | M5 x 10 mm Torx screw<br>M6 x 12 mm Torx screw | 3.2 N•m (28 lb•in)<br>6.8 N•m (60 lb•in) |
| SK-L1-HPWRS2-F3 | J2-to-J5 Power Interface Harness | M5 x 10 mm Torx screw | 3.2 N•m (28 lb•in) |
| SK-L1-CBL2-F2 | Converter-to-Inverter PWR (Power) Interface Jumper | | |
| SK-L1-HGD1-F2 | Voltage Feedback Harness | | |
| SK-L1-MVF1-C | Motor Voltage Feedback PCB, 400V | Nylon snap-on standoffs and nylon rivets | — |

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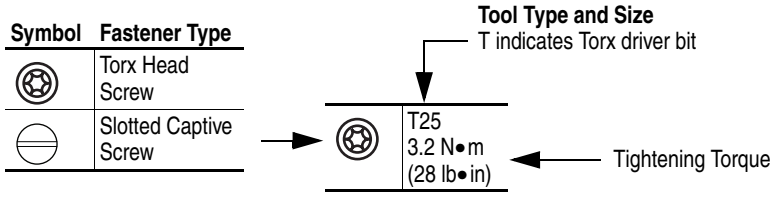
### Understanding Torque Figures in Assembly Diagrams

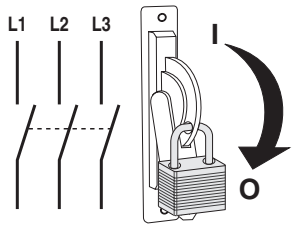
Icons and numbers in the assembly diagrams indicate how to tighten hardware:




## Removing Power from the Drive

**ATTENTION:** To avoid an electric shock hazard, verify that the voltage on the Power Module DC bus capacitors has discharged completely before performing any work on the drive.

1. Turn off and lock out input power. Wait 5 minutes.




2. Measure the DC bus voltage at the DC+ and DC- TESTPOINT sockets on the lower front of the power module (see Figure 2.2 on page 2-5 for details). The measured voltage must be zero (0).

Remove power before making or breaking cable connections. When you remove or insert a cable connector with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

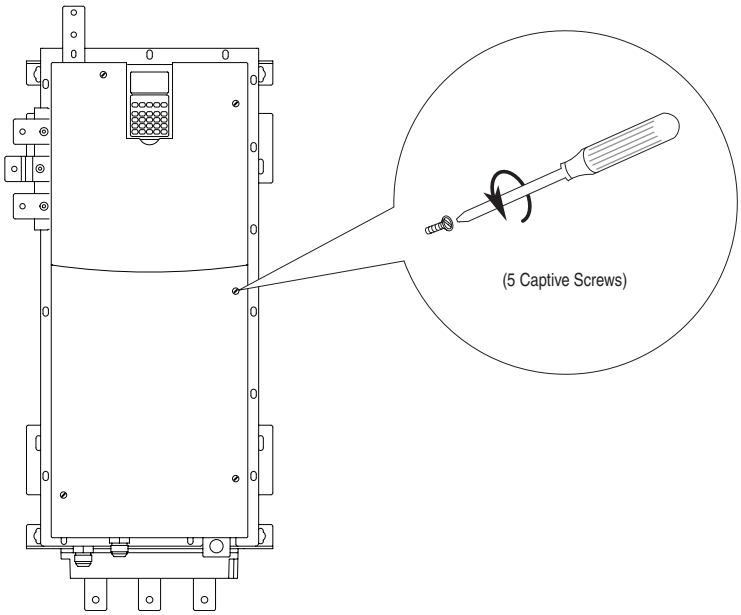
- Sending an erroneous signal to your system's field devices, causing unintended machine motion.
- Causing an explosion in a hazardous environment.

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

## Removing the Drive Front Cover

### Removal

1. Remove power from the drive (see Removing Power from the Drive on page 3-3).
2. Unfasten the five (5) M5 x 16 mm (0.63 in.) long slotted captive screws that secure the drive cover, and remove the cover.




### Installation

1. Place the cover on the front of the drive and align it to the edges of the drive.
2. Tighten the five (5) M5 x 16 mm (0.63 in.) long slotted captive screws to secure the cover to the drive.

## Removing the HIM Option

### Removal/Installation

The HIM can be removed or installed while the drive is powered.

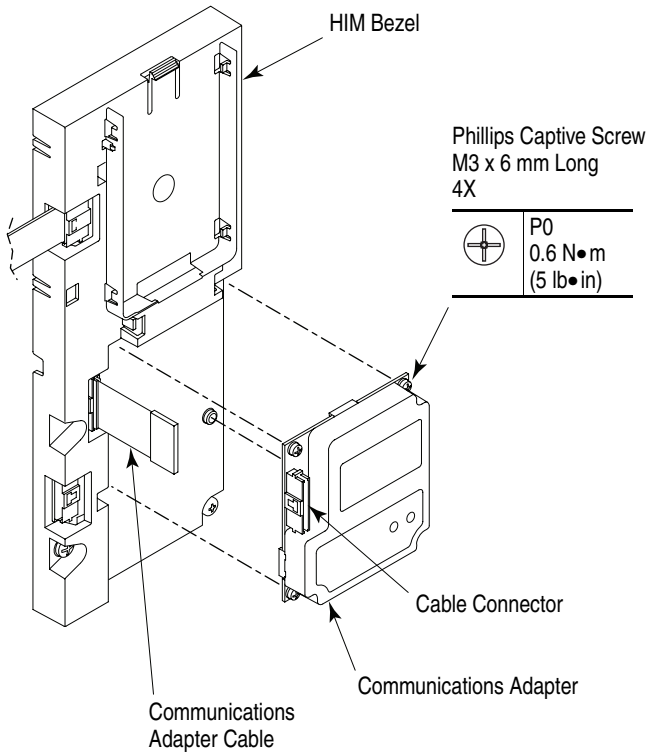
**Important:** HIM removal is only permissible in Auto mode. If the HIM is removed while in Manual mode or the HIM is the only remaining control device, a fault will occur.

| Step | Key(s) | Example Displays |
|---|---|---|
| To remove the HIM:<br>1. Press ALT and then Enter (Remove). The Remove HIM confirmation screen appears.<br>2. Press Enter to confirm you want to remove HIM.<br>3. Remove the HIM from the drive.<br>To install the HIM, insert into drive or connect cable. | ALT + ↵ | Remove Op Intrfc:<br>Press Enter to<br>Disconnect Op Intrfc?<br>(Port 1 Control) |

## Removing the Communications Adapter Option

### Removal

1. Remove power from the drive (see Removing Power from the Drive on page 3-3).
2. Remove the drive front cover (see Removing the Drive Front Cover on page 3-4).
3. Disconnect the communications adapter cable from its mating connector on the communications adapter.
4. Unfasten the four (4) M3 x 6 mm (0.24 in.) long Phillips captive screws that secure communications adapter, and remove the adapter.




### Installation

Install the communications adapter in reverse order of removal, while referring to the torque specification shown in the drawing.

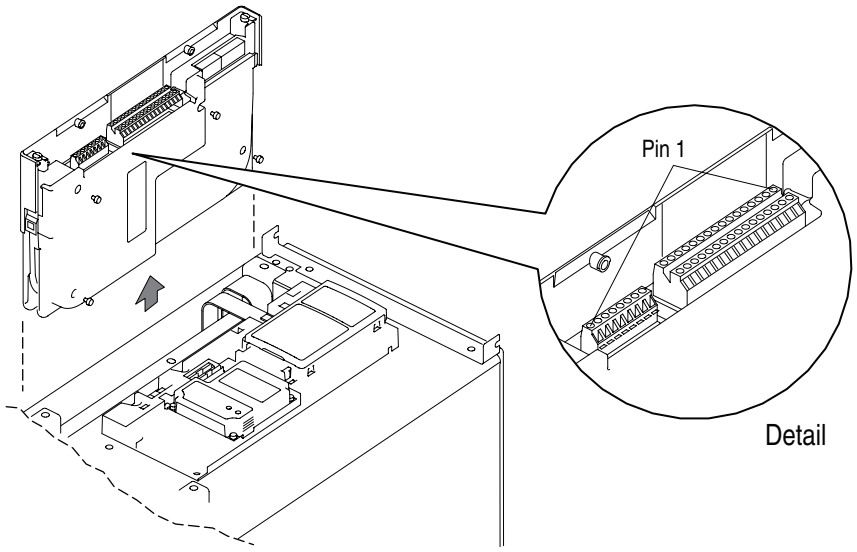
## Removing the Inverter Control Cassette

Depending on the drive control option, the inverter is equipped with either the 700 Vector Control or the 700S Phase II Control cassette.

### 700 Vector Control Cassette (24V or 115V)

Removal

1. Remove power from the drive (see Removing Power from the Drive on page 3-3).
2. Remove the drive front cover (see Removing the Drive Front Cover on page 3-4).
3. Follow standard ESD procedures.
4. Disconnect the 700 vector control synchronization cable terminal block TB2.
5. Disconnect the 40-Pin MCB cable from connector J2. Leave the cable's other end connected to the addressable power PCB.
6. Disconnect the 30-Pin communications interface cable from connector J3. Leave the cable's other end connected to the communications interface PCB.
7. Disconnect the I/O terminal block TB1.
8. Disconnect the encoder terminal block J1 (if installed).
9. Loosen the two (2) screw latches on the front of the cassette and slide the cassette out from the cassette mounting bracket.



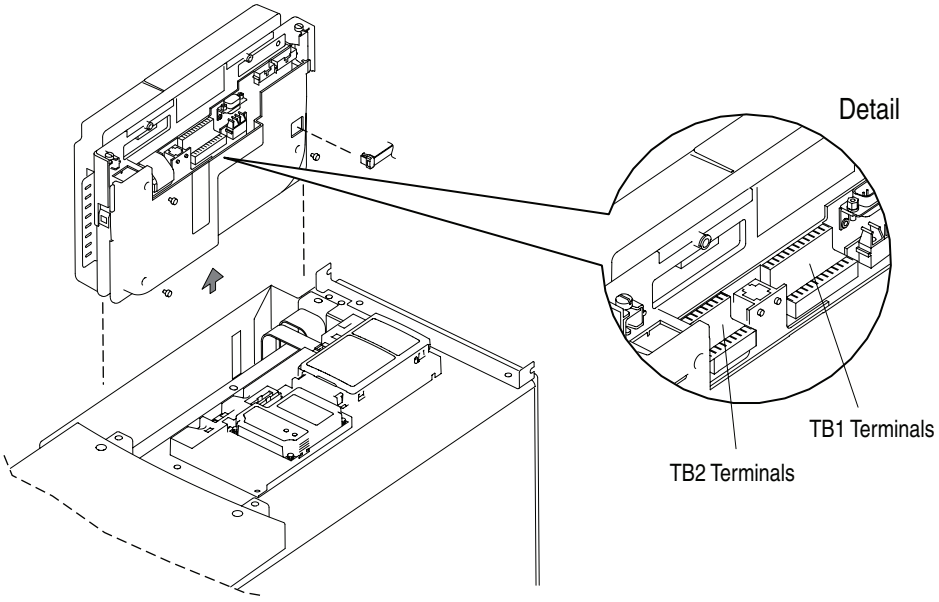

Installation

Install the cassette in reverse order of removal. Hand tighten the two (2) cassette screw latches to the cassette mounting bracket.

## 700S Phase II Control Cassette

### Removal

1. Remove power from the drive (see Removing Power from the Drive on page 3-3).
2. Remove the drive front cover (see Removing the Drive Front Cover on page 3-4).
3. Follow standard ESD procedures.
4. Disconnect the 40-Pin MCB cable from connector P1. Leave the cable's other end connected to the addressable power PCB.
5. Disconnect the 30-Pin communications interface cable from connector P2. Leave the cable's other end connected to the communications interface PCB.
6. Disconnect four (4) I/O terminal blocks TB1 and TB2.
7. Loosen the two (2) screw latches on the front of the cassette and slide the cassette out from the cassette mounting bracket.
8. Disconnect the 700S synchronization cable connector P6. Remove and save the tape holding the cable to the cassette.




### Installation

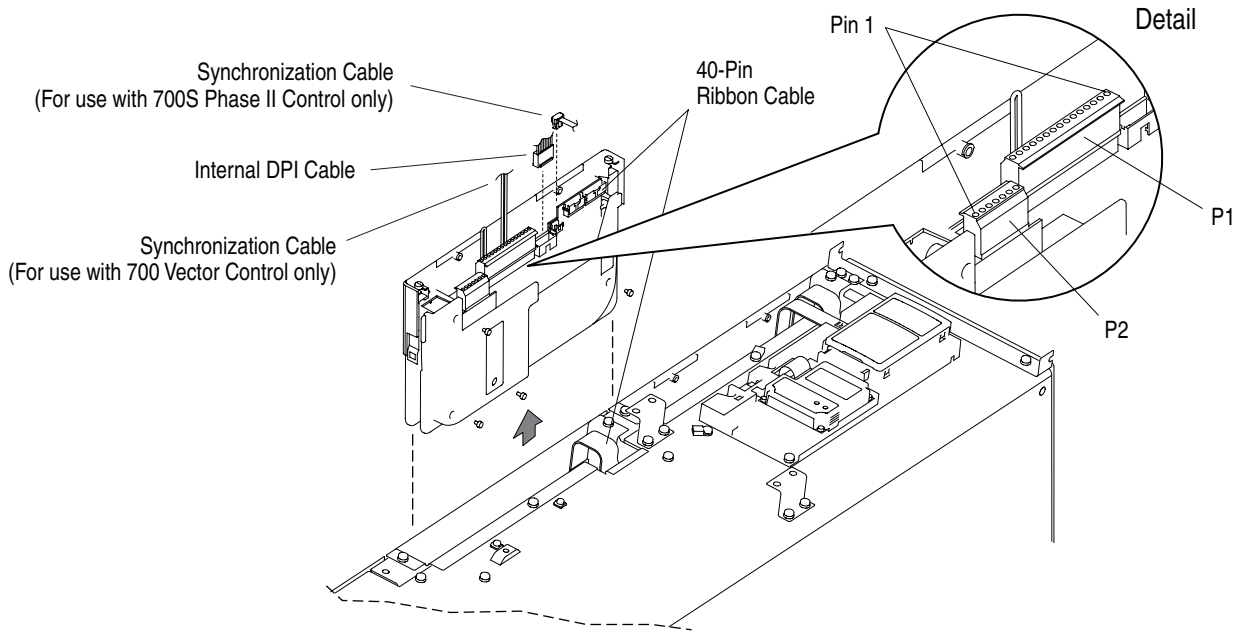
Install the cassette in reverse order of removal. Hand tighten the two (2) cassette screw latches to the cassette mounting bracket.

## Removing the Active Converter Control Cassette

### Removal

1. Remove power from the drive (see Removing Power from the Drive on page 3-3).
2. Remove the drive front cover (see Removing the Drive Front Cover on page 3-4).
3. Follow standard ESD procedures.
4. Disconnect the internal DPI cable from connector J4.
5. Disconnect the 700S control synchronization cable (if installed) from connector J9.
6. Disconnect the 40-Pin MCB cable from connector J1. Leave the cable's other end connected to the addressable power PCB.
7. Disconnect the I/O terminal block P1.

   **Important:** Do not disconnect the 700 vector control synchronization cable (if installed) from P1-7 and P1-8.
8. Disconnect the voltage feedback resistor PCB terminal block P2.
9. Loosen the (2) two screw latches on the front of the cassette and slide the cassette out from the cassette mounting bracket.



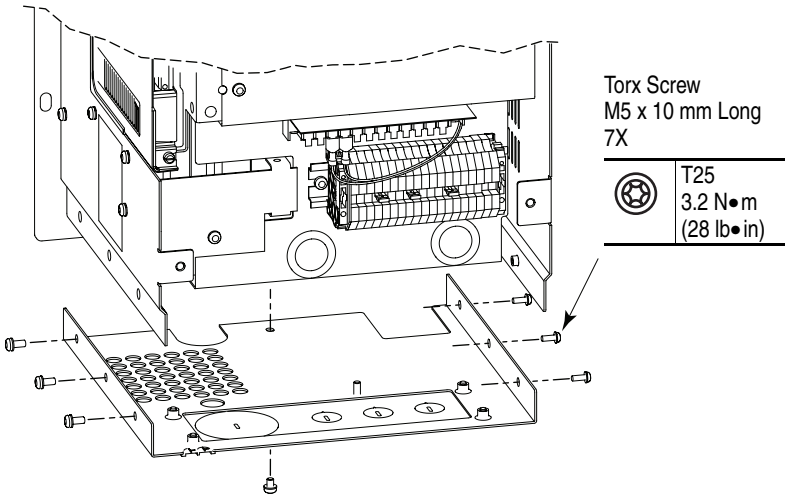

### Installation

Install the cassette in reverse order of removal. Hand tighten the two (2) cassette screw latches to the cassette mounting bracket.

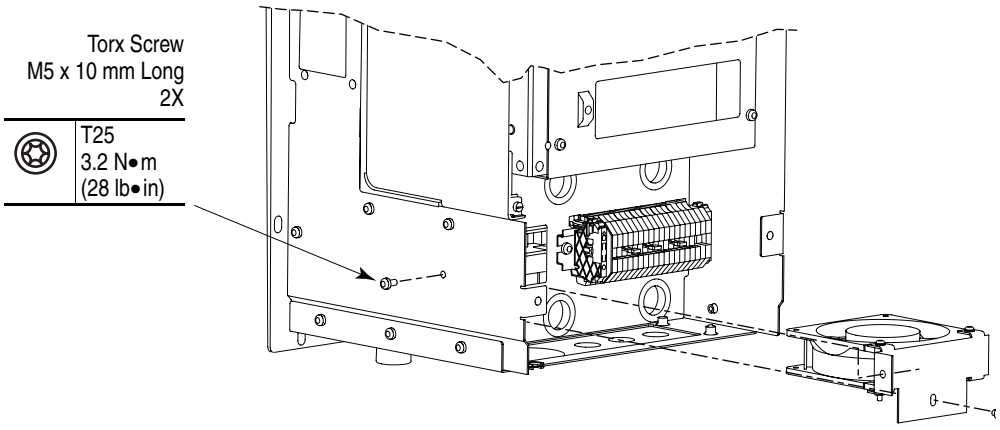
## Removing the Power Section Stirring Fan

### Removal

1. Remove power from the drive (see Removing Power from the Drive on page 3-3).
2. Remove the drive front cover (see Removing the Drive Front Cover on page 3-4).
3. Follow standard ESD procedures.
4. Unfasten the seven (7) M5 x 10 mm (0.39 in.) long Torx screws that secure the bottom drive cover, and remove the cover.




5. Unfasten two (2) M5 x 10 mm (0.39 in.) long Torx bracket screws that secure the fan, disconnect the fan power leads (two fastons), and lift the fan from the drive.




### Installation

Install the fans and fan harness in reverse order of removal while referring to torque specifications shown in the drawings.

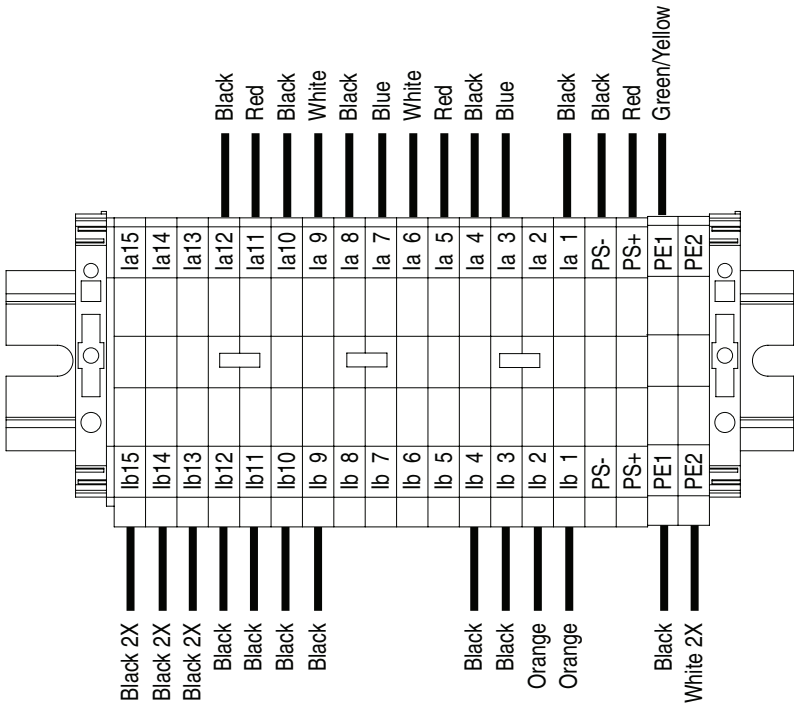
**Important:** Fan airflow direction is into the Power Section.

## Removing the Drive Front Panel

In most cases, the drive front panel must be removed first to access the drive component for its removal and replacement.

### Removal

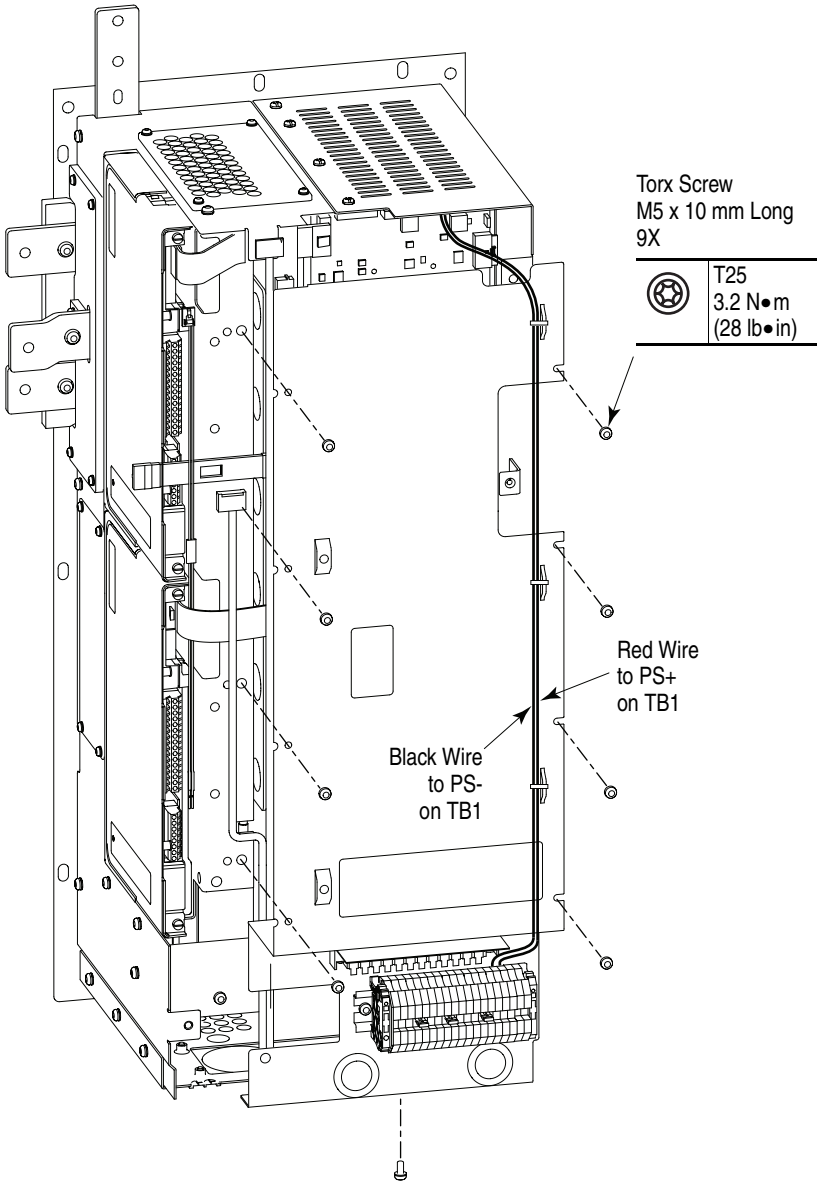
1. Remove the power section stirring fan from the drive (see Removing the Power Section Stirring Fan on page 3-9).
2. Follow standard ESD procedures.
3. Verify each wire connected to the TB1 terminal block is labeled with the terminal designation to which it is connected. If not, label the wire accordingly. Thereafter, disconnect all wires from TB1. The drawing below shows all of the wires connected to TB1.




4. See Figure 3.1 and remove the three (3) tie wraps securing the PS- (black) and PS+ (red) wires to the drive front panel.

5. See Figure 3.1 and unfasten the nine (9) M5 x 10 mm (0.39 in.) long Torx screws that secure the drive front panel. Then remove the drive front panel.

**Figure 3.1 Removing the Drive Front Panel**



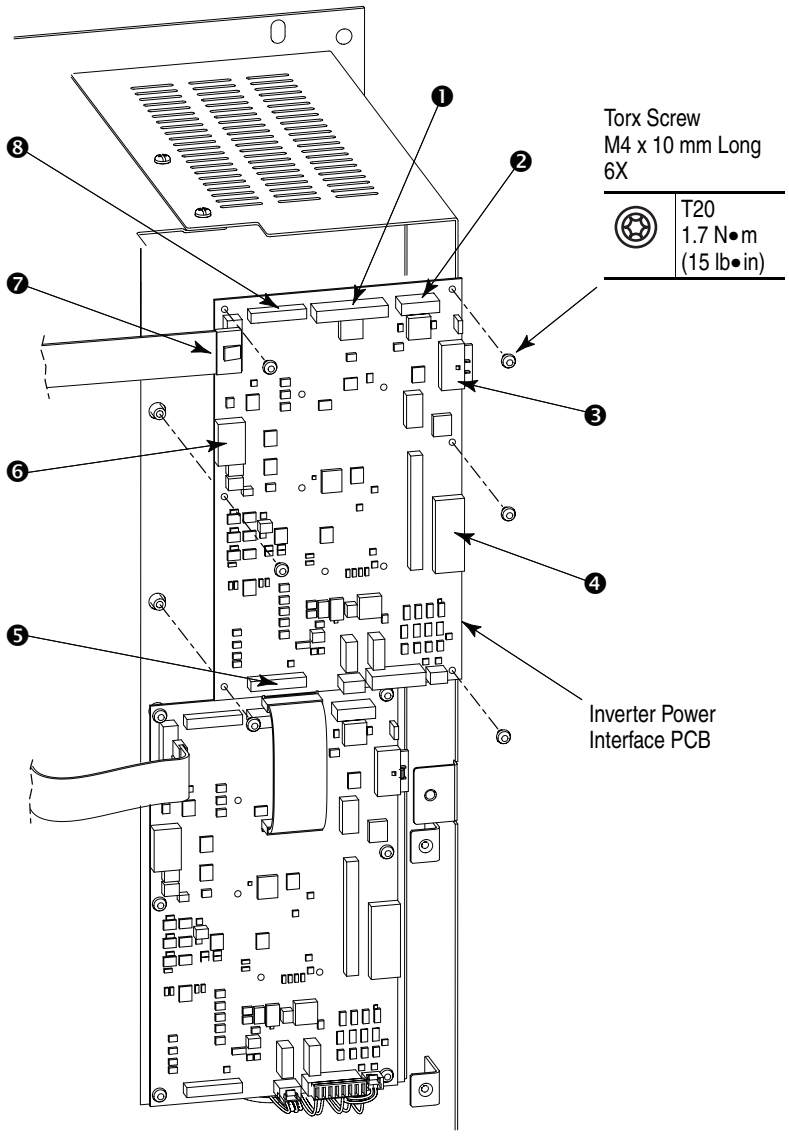

## Installation

Install the drive front panel in reverse order of removal while referring to the torque specification shown in the drawing.

## Replacing the Inverter Power Interface PCB

### Removal

1. Remove the drive front panel (see Removing the Drive Front Panel on page 3-10).
2. Disconnect the stirring fan power leads (two fastons) from the input filter fan power supply PCB.
3. Detach the eight (8) cable connectors (items ❶ through ❽ as shown in the following drawing) from the inverter power interface PCB.




4. Remove the six (6) M4 x 10 mm (0.39 in.) long Torx screws that secure the inverter power interface PCB, and remove the board.

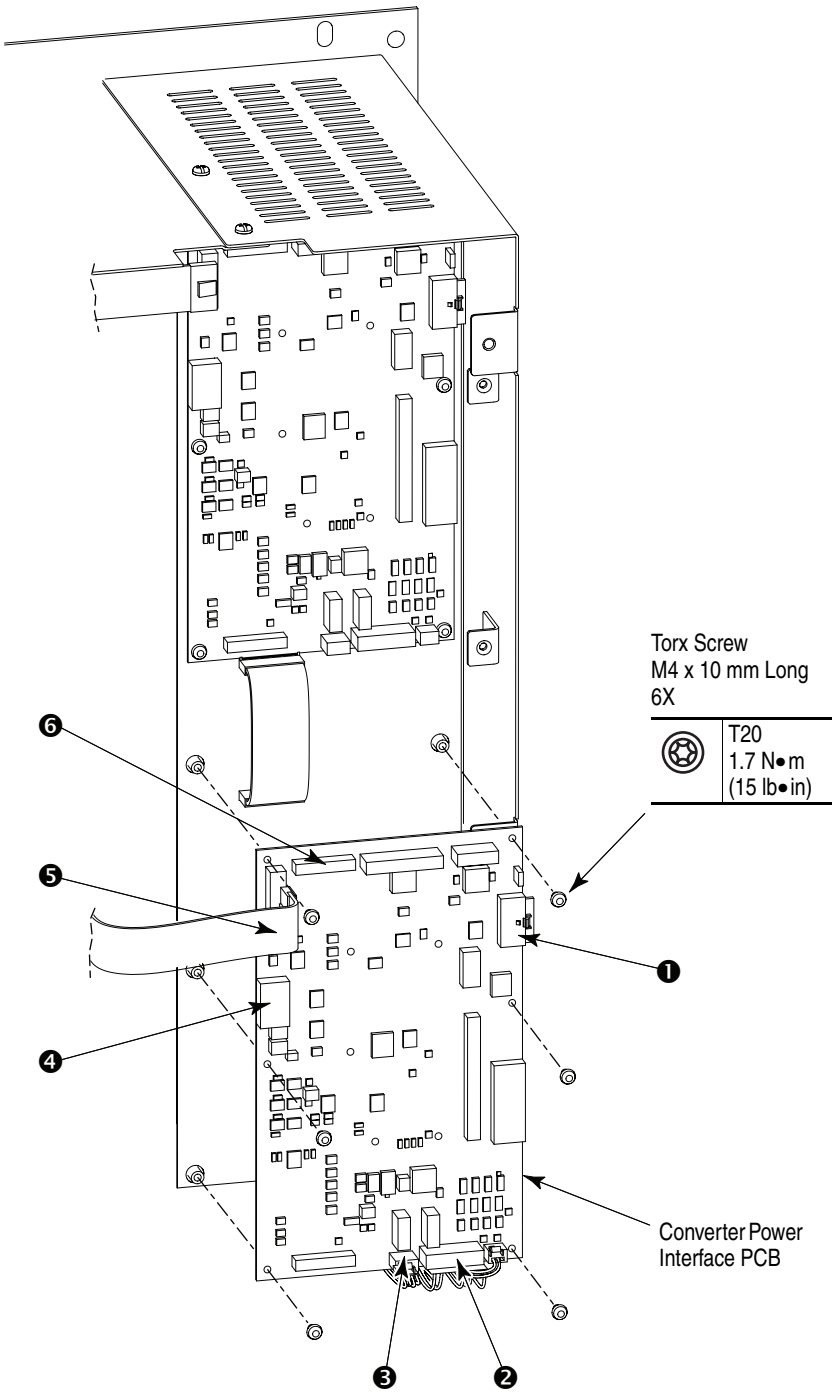
### Installation

Install the inverter power interface PCB in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the Converter Power Interface PCB

### Removal

1. Remove the drive front panel (see Removing the Drive Front Panel on page 3-10).
2. Disconnect the stirring fan power leads (two fastons) from the input filter fan power supply PCB.
3. Detach the six (6) cable connectors (items ❶ through ❻ as shown in the following drawing) from the converter power interface PCB.



4. Remove the six (6) M4 x 10 mm (0.39 in.) long Torx screws that secure the converter power interface PCB, and remove the board.

### Installation

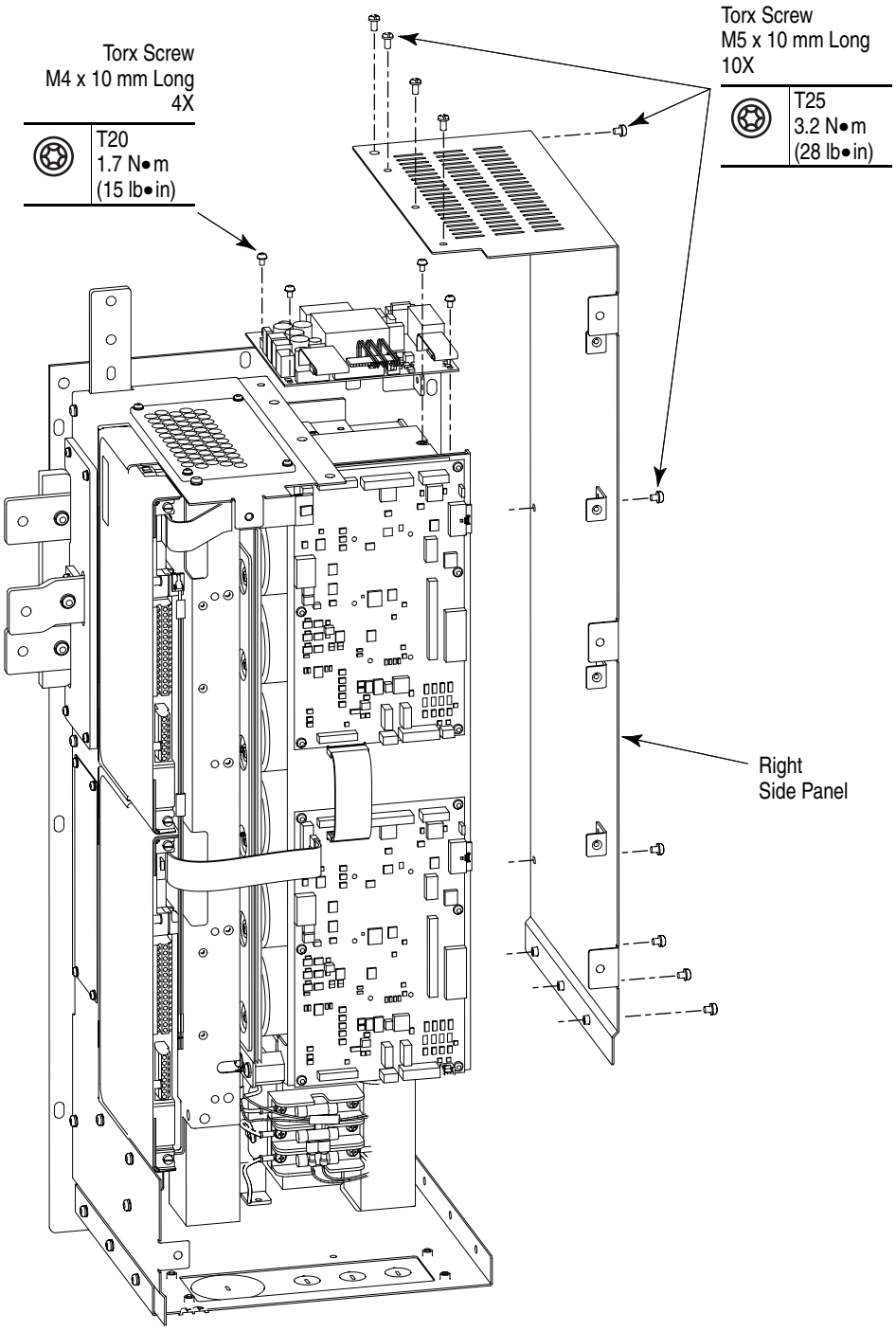
Install the converter power interface PCB in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the PCB Power Supply

### Removal

1. Remove the drive front panel (see Removing the Drive Front Panel on page 3-10).
2. See Figure 3.2 on page 3-15 and unfasten the ten (10) M5 x 10 mm (0.39 in.) long Torx screws that secure the right side panel at the top, side, and bottom of the panel. Then remove the right side panel.
3. Disconnect the three (3) ribbon cables from the inverter power interface PCB.
4. Unfasten the four (4) M4 x 10 mm (0.39 in.) long Torx screws that secure the PCB power supply, and remove the board.

**Figure 3.2 Removing the Drive Right Side Panel**



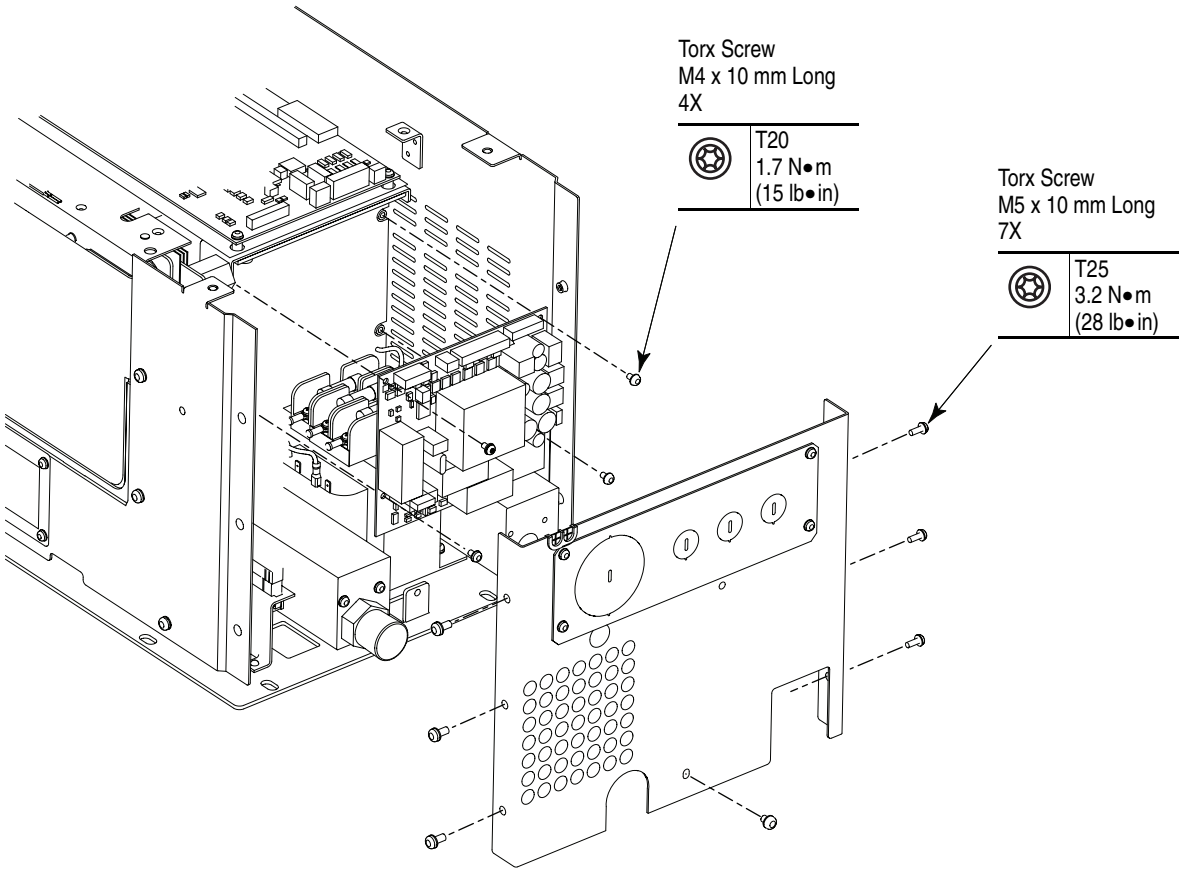

## Installation

Install the PCB power supply in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the Input Filter Fan Power Supply

### Removal

1. Remove the drive front panel (see Removing the Drive Front Panel on page 3-10).
2. Unfasten the seven (7) M5 x 10 mm (0.39 in.) long Torx screws that secure the bottom drive cover. Then remove the bottom drive cover.
3. Disconnect the red and white wires from the DC bus, and the cable connector from the filter fan.
4. Unfasten the four (4) M4 x 10 mm (0.39 in.) long Torx screws that secure the input filter fan power supply, and remove the power supply.



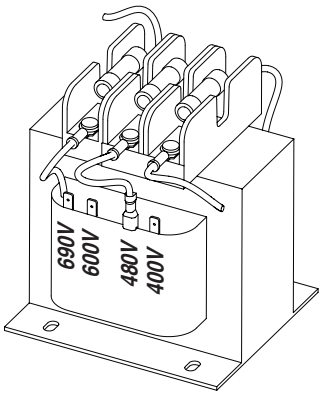

### Installation

Install the input filter fan power supply in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the Control Transformer Fuses

### Removal

1. Remove the power section stirring fan (see Removing the Power Section Stirring Fan on page 3-9) to access the control transformer fuses.




2. Replace the blown fuse(s) with the same type and equivalent-rated fuse(s).

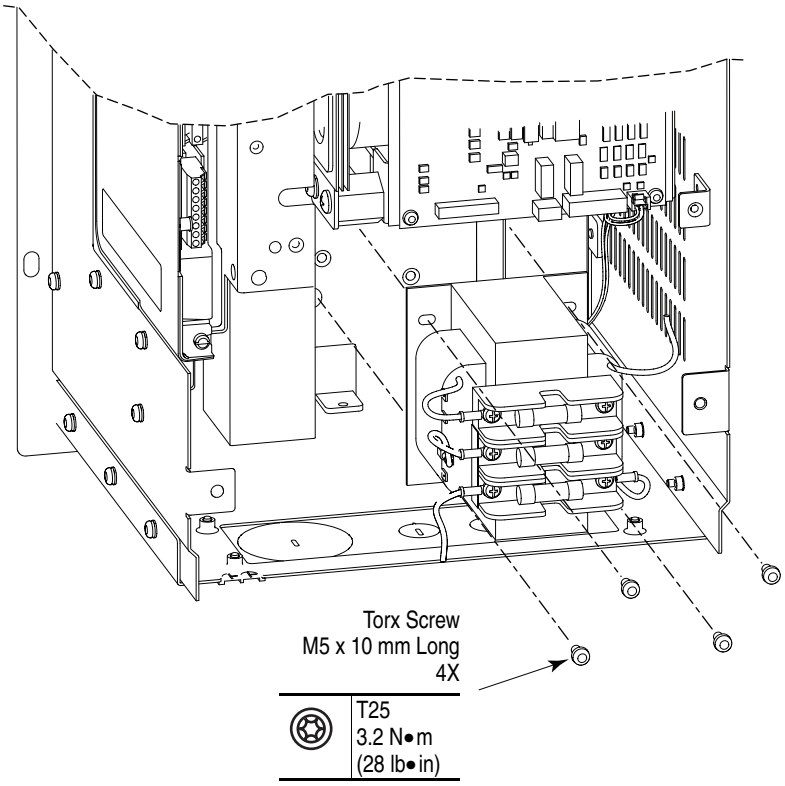
### Installation

Install all drive components in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the Control Transformer

### Removal

1. Remove the power section stirring fan (see Removing the Power Section Stirring Fan on page 3-9) to access the control transformer.
2. Remove the drive front panel (see Removing the Drive Front Panel on page 3-10).
3. Disconnect the three (3) black wires from the control transformer.
4. Remove the four (4) M5 x 10 mm (0.39 in.) long Torx screws that secure the control transformer, and remove the transformer.



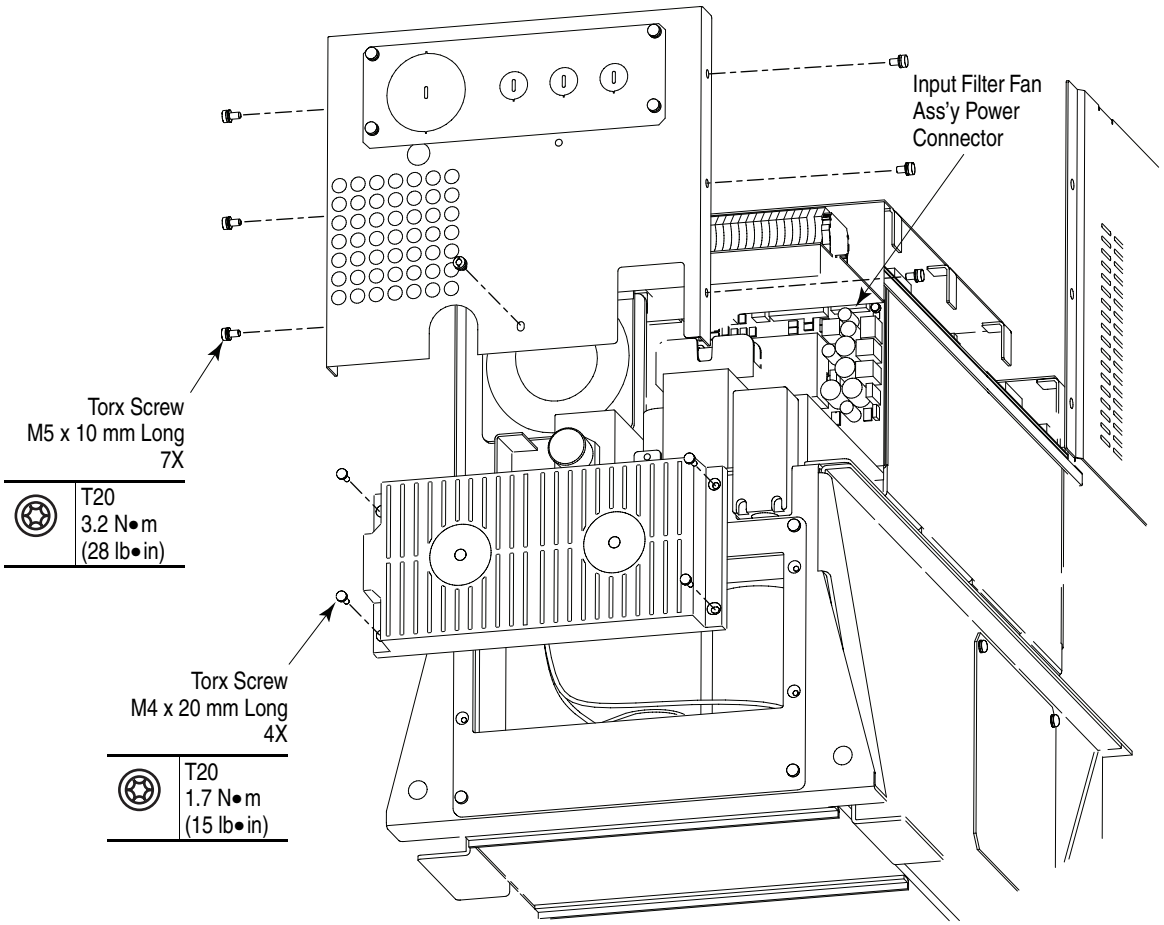

### Installation

Install the control transformer in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the Input Filter Fan Assembly

### Removal

1. Remove power from the drive (see Removing Power from the Drive on page 3-3).
2. See Figure 3.2 and unfasten the ten (10) M5 x 10 mm (0.39 in.) long Torx screws that secure the right side panel at the top, side, and bottom of the panel. Then remove the right side panel.
3. Unfasten the seven (7) M5 x 10 mm (0.39 in.) long Torx screws that secure the bottom drive cover. Then remove the bottom drive cover.
4. Unfasten the four (4) M4 x 20 mm (0.79 in.) long Torx screws that secure the input filter fan assembly, and remove the assembly.




5. Locate the input filter fan assembly power connector (see drawing above) and disconnect it from the input filter fan power supply.

### Installation

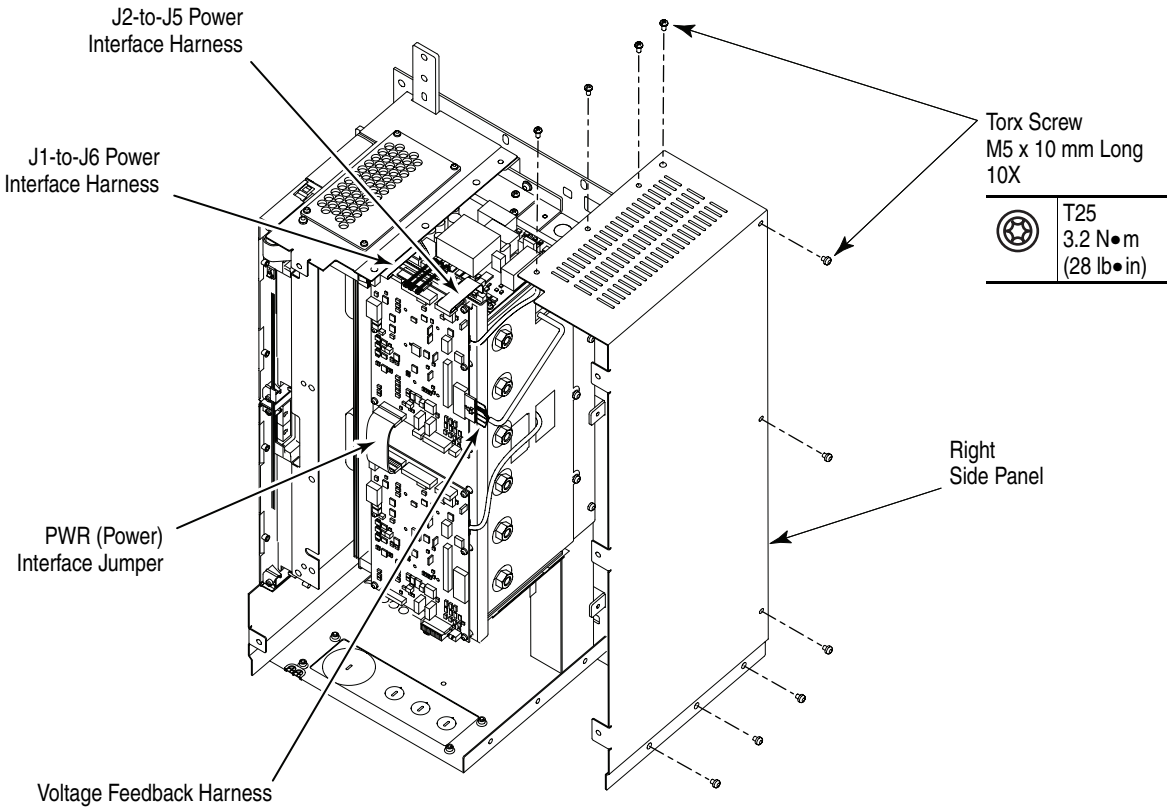
Install the input filter fan assembly in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the J1-to-J6 Power Interface Harness

### Removal

1. Remove the drive front panel (see Removing the Drive Front Panel on page 3-10).
2. See Figure 3.3 and unfasten the ten (10) M5 x 10 mm (0.39 in.) long Torx screws that secure the right side panel at the top, side, and bottom of the panel. Then remove the right side panel.

**Figure 3.3 Drive Harness Locations**




3. Disconnect the J1-to-J6 power interface harness from both the power supply PCB and the inverter power interface PCB.

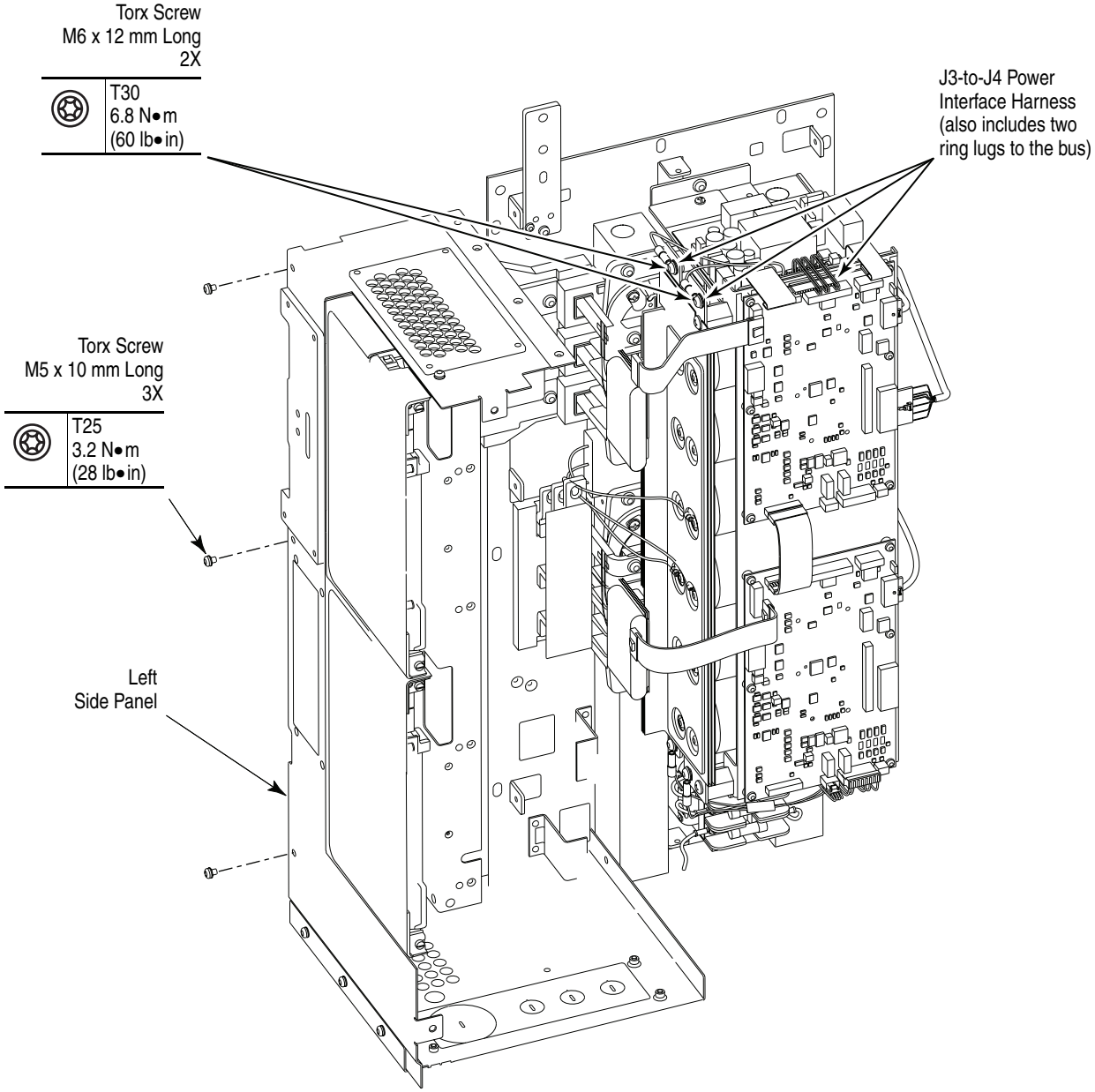
### Installation

Install the J1-to-J6 power interface harness in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the J3-to-J4 Power Interface Harness

### Removal

1. Remove the drive front panel (see Removing the Drive Front Panel on page 3-10).
2. See Figure 3.3 on page 3-20 and unfasten the ten (10) M5 x 10 mm (0.39 in.) long Torx screws that secure the right side panel at the top, side, and bottom of the panel. Then remove the right side panel.
3. Unfasten the three (3) M5 x 10 mm (0.39 in.) long Torx screws that secure the left side panel. Then remove the left side panel.



4. Unfasten the two (2) M6 x 12 mm (0.47 in.) long Torx screws that secure the ring lugs of the J3-to-J4 power interface harness to the DC bus. Then remove the ring lugs and disconnect the J3-to-J4 power interface harness from the inverter power interface PCB.

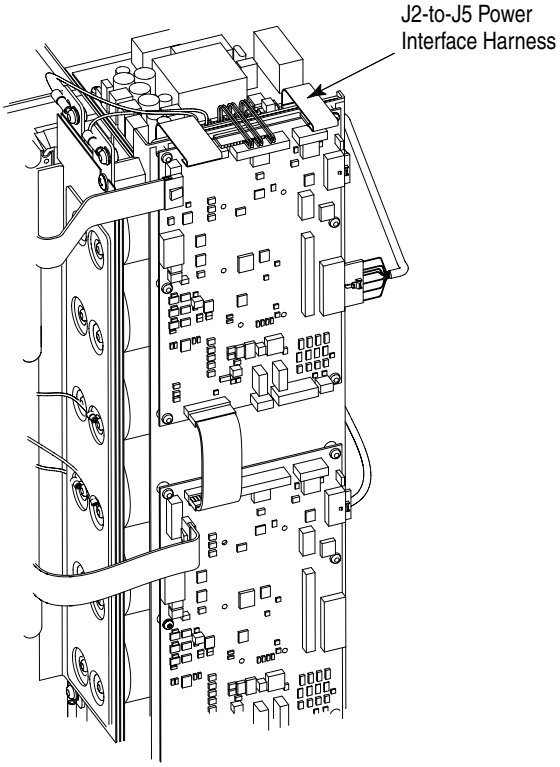
### Installation

Install the J3-to-J4 power interface harness in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the J2-to-J5 Power Interface Harness

### Removal

1. Remove the drive front panel (see Removing the Drive Front Panel on page 3-10).
2. See Figure 3.3 on page 3-20 and unfasten the ten (10) M5 x 10 mm (0.39 in.) long Torx screws that secure the right side panel at the top, side, and bottom of the panel. Then remove the right side panel.
3. Disconnect the J2-to-J5 power interface harness from both the power supply PCB and the inverter power interface PCB.



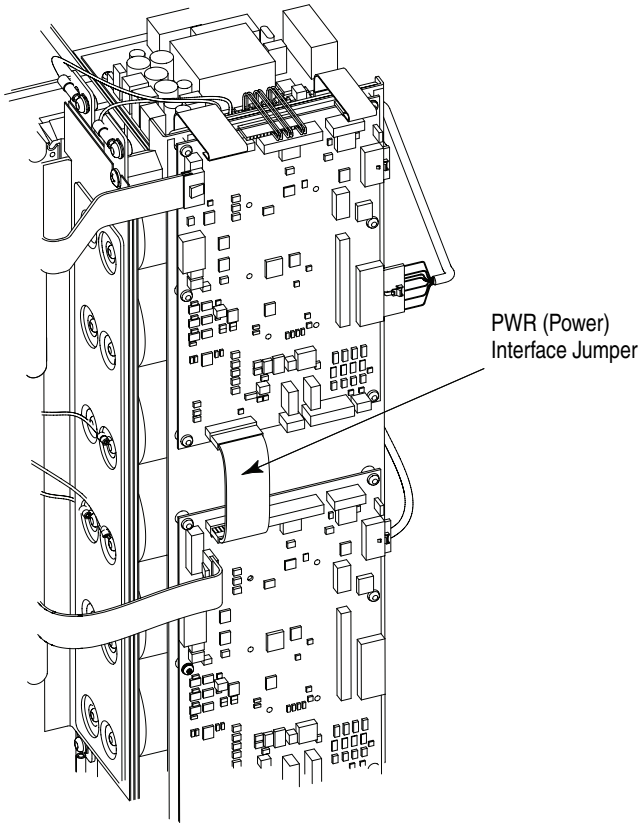

### Installation

Install the J2-to-J5 power interface harness in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the PWR (Power) Interface Jumper

### Removal

1. Remove the drive front panel (see Removing the Drive Front Panel on page 3-10).
2. Disconnect the PWR (Power) interface jumper from both the inverter power interface PCB and the converter power interface PCB.



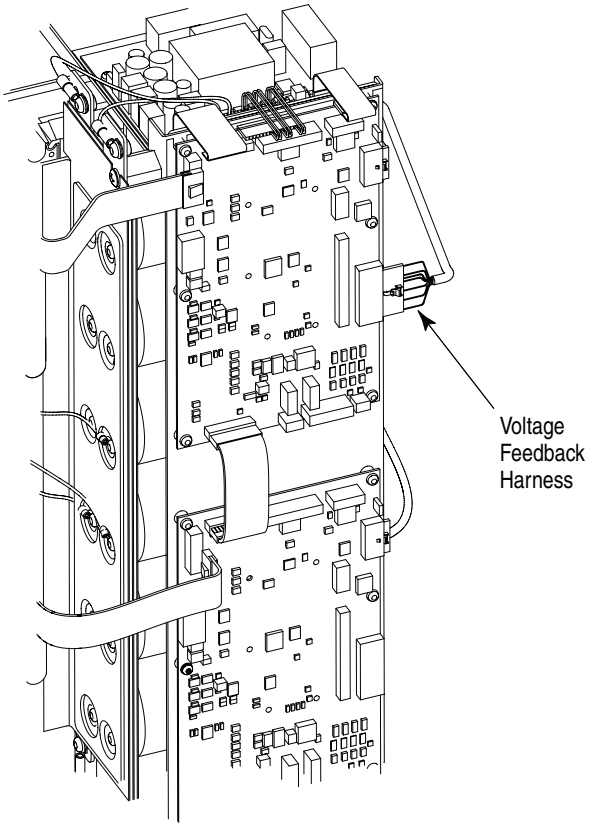

### Installation

Install the PWR (Power) interface jumper in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the Voltage Feedback Harness

### Removal

1. Remove the drive front panel (see Removing the Drive Front Panel on page 3-10).
2. See Figure 3.3 on page 3-20 and unfasten the ten (10) M5 x 10 mm (0.39 in.) long Torx screws that secure the right side panel at the top, side, and bottom of the panel. Then remove the right side panel.
3. Disconnect the voltage feedback harness from both the power supply PCB and the inverter power interface PCB.



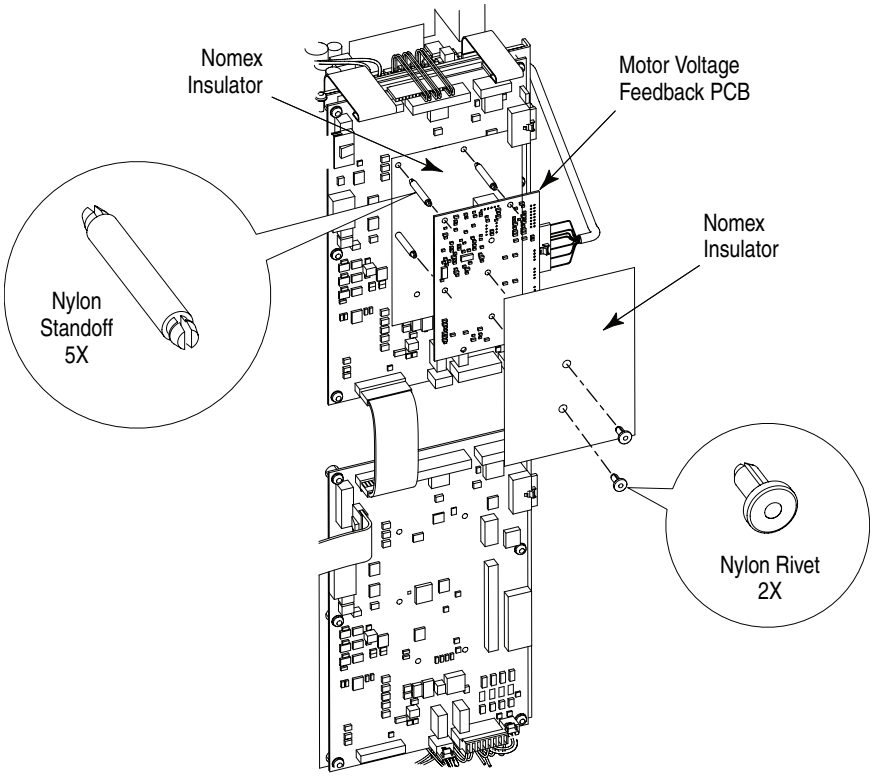

### Installation

Install the voltage feedback harness in reverse order of removal, while referring to the torque specifications shown in the drawings.

## Replacing the Motor Voltage Feedback PCB (700S Phase II Control only)

### Removal

1. Remove the drive front panel (see Removing the Drive Front Panel on page 3-10).
2. Remove the two (2) nylon rivets that secure the Nomex insulator, and remove the insulator. (Note: New rivets are included in the motor voltage feedback PCB spare parts kit.)
3. Unsnap the five (5) nylon standoffs that secure the motor voltage feedback PCB, and remove the board. (Note: New nylon standoffs are included in the motor voltage feedback PCB spare parts kit.)




### Installation

Install the motor voltage feedback PCB in reverse order of removal, while referring to the torque specifications shown in the drawings.

**Important:** Make sure that both Nomex insulators are in position as shown in the drawing above when installing the replacement motor voltage feedback PCB.

## Notes:

# Start-Up After Repair

**ATTENTION:** Power must be applied to the drive to perform the following start-up procedure. Some of the voltages present are at incoming line potential. To avoid electric shock hazard or damage to equipment, only qualified service personnel should perform the following procedure. Thoroughly read and understand the procedure before beginning. If an event does not occur while performing this procedure, Do Not Proceed. Remove Power including user-supplied control voltages. User-supplied voltages may exist even when main AC power is not applied to the drive. Correct the malfunction before continuing.

| | | |
|---|---|---|
| **Phone** | United States/ Canada | 1.262.512.8176 (7 AM - 6 PM CST)<br>1.440.646.5800 (24 hour support) |
| | Outside United States/Canada | You can access the phone number for your country via the Internet:<br>Go to http://www.ab.com<br>Click on *Support* (http://support.rockwellautomation.com/)<br>Under *Contact Customer Support*, click on *Phone Support* |
| **Internet** | ⇒ | Go to http://www.ab.com/support/abdrives/ |
| **E-mail** | ⇒ | support@drives.ra.rockwell.com |

Be prepared to provide the following information when you contact support:

- Product Catalog Number
- Product Serial Number
- Firmware Revision Level

## Performing the Power Circuit Diagnostic Test (700S Phase II Control only)

The Power Circuit Diagnostic Test, for the PowerFlex 700L with 700S Phase II Control, allows you to diagnose problems in the drive's power structure without applying large amounts of power.

1. Verify that input power wiring and grounding is connected.
2. Verify that the motor cables are connected.
3. Energize the drive.

4. From the Monitor menu on the HIM, press the Esc (Escape) key to navigate to the Main menu.
5. Use the (Down) key to select Start-Up and press the (Enter) key to enter Start-Up. Then press the (Enter) key again to verify your intention to continue with the Start-Up menu.
6. Use the (Down) key to select Pwr Circuit Diag and press the (Enter) key to enter Power Circuit Diagnostics.
7. Press the (Start) key to start the Power Circuit Diagnostic routine. Follow indications and instructions on the HIM.

## Testing With the Motor

This test allows you to measure several operating parameters and diagnose problems without connecting the motor to its mechanical load.

1. Verify that input power wiring and grounding is connected.
2. Verify that the motor cables are connected.
3. Verify that the motor load is disconnected.
4. Energize the drive.
5. Start the drive and increase the speed from zero to base speed.
6. Measure drive output current on all three phases, and verify that the value is reflected in:
   - parameter 003 [Output Current] (700 Vector Control)
   - parameter 308 [Output Current] (700S Phase II Control)
7. Stop the drive.

# Service Tools and Equipment

## Software Tools

DriveTools™ SP, DriveExecutive, DriveExplorer™, and DriveObserver™ are software tools for uploading, downloading, and monitoring system parameters.

## Service Tools

Service of the PowerFlex 700L Frame 2 drive requires certain kinds of tools, devices, and test equipment. Basic tools, devices, and test equipment have to meet requirements of professional services. The tools have to be in good condition and have to fit how and where they are going to be used.

This list of basic service tools covers the needs of tools for repair and maintenance measurements.

| Item | Description | Details |
|---|---|---|
| 1 | Oscilloscope | Portable, digitizing, dual channel scope, with isolation |
| 2 | Current clamp | 1000 A (AC, rms), signal output |
| 3 | Soldering station | Soldering / de-soldering |
| 4 | Adjustable power supply | 0…1300V DC, 1 A, adjustable current limit. Efore LPS 750-HV or equivalent. |
| 5 | Adjustable power supply | 0…690V AC (+10%), 10 A, three phase, galvanic isolation |
| 6 | Multi-meter | Digital multi-meter, capable of AC and DC voltage, continuity, resistance, capacitance measurements, and forward diode bias tests. Fluke model 87 III or equivalent. |
| 7 | Insulation tester | 1000V DC |
| 8 | Torque wrench | 1…12 N•m |
| 9 | Torque wrench | 6…50 N•m |
| 10 | Nose pliers | |
| 11 | Flat blade screw driver | 2…7 mm |
| 12 | Phillips screw driver | 1, 2, 3 |
| 13 | Torx screw driver | T25, T30, T35 |
| 14 | ESD-protected place of work | Working surface, floor covering, seat, and earthings |
| 15 | ESD-protective clothing | Wrist wrap, shoes, overall clothing (coat) |
| 16 | Power supply (service) | Capacity of three phase service 400/500/690V AC, 250 A |

## Notes:

# Connector Descriptions


| For Details on... | See Page... |
|---|---|
| J1-to-J6 Power Interface Harness | B-1 |
| J2-to-J5 Power Interface Harness | B-1 |
| J3-to-J4 Power Interface Harness | B-2 |
| PWR (Power) Interface Jumper | B-2 |
| Voltage Feedback Harness | B-2 |
| Motor Voltage Feedback PCB | B-3 |
| Converter Power Interface Board to Terminal Block | B-3 |
| Converter Control Board to Power Supply and DC Bus | B-4 |
| Temperature Switches to Fan | B-4 |
| Power and Ground to Contactors and Voltage Feedback | B-4 |
| Control Transformer and Converter Control to Contactors | B-5 |
| Power Supply to Stirring Fan | B-5 |


## J1-to-J6 Power Interface Harness

| 80W Power Supply Board | Pin Number | to | Pin Number | Inverter Power Interface Board | Description |
|---|---|---|---|---|---|
| J1 | 1 | ... | 1 | J6 | FB Bus |
| | 2 | ... | 2 | | AD Gnd |
| | 3 | ... | 3 | | AD Gnd |
| | 4 | ... | 4 | | +5V |
| | 5 | ... | 5 | | +5V |
| | 6 | ... | 6 | | -12VDC |
| | 7 | ... | 7 | | AD Gnd |
| | 8 | ... | 8 | | +12V |
| | 9 | ... | 9 | | 24V Com |
| | 10 | ... | 10 | | +24VDC |
| | 11 | ... | 11 | | 24V Fan |
| | 12 | ... | 12 | | — |
| | 13 | ... | 13 | | — |

## J2-to-J5 Power Interface Harness

| 80W Power Supply Board | Pin Number | to | Pin Number | Terminal Block | Description |
|---|---|---|---|---|---|
| J2 | 1 | ... | 1 | J5 | — |
| | 2 | ... | 2 | | — |
| | 3 | ... | 3 | | GPWR Rtn W- |
| | 4 | ... | 4 | | Gate PWR W- |
| | 5 | ... | 5 | | GPWR Rtn V- |
| | 6 | ... | 6 | | Gate PWR V- |
| | 7 | ... | 7 | | GPWR Rtn U- |
| | 8 | ... | 8 | | Gate PWR U- |

## J3-to-J4 Power Interface Harness

| 80W Power Supply Board | Pin Number | to | Pin Number | Inverter Power Interface Board | Description |
|---|---|---|---|---|---|
| J3 | 1 | … | 1 | J4 | +Bus |
| | 2 | … | 2 | | — |
| | 3 | … | 3 | | — |
| | 4 | … | 4 | | -Bus |
| | 5 | … | 5 | | — |
| | 6 | … | 6 | | — |
| | 7 | … | 7 | | Gate PWR W+ |
| | 8 | … | 8 | | GPWR Rtn W+ |
| | 9 | … | 9 | | — |
| | 10 | … | 10 | | — |
| | 11 | … | 11 | | Gate PWR V+ |
| | 12 | … | 12 | | GPWR Rtn V+ |
| | 13 | … | 13 | | — |
| | 14 | … | 14 | | — |
| | 15 | … | 15 | | Gate PWR W+ |
| | 16 | … | 16 | | GPWR Rtn W+ |

## PWR (Power) Interface Jumper

| Inverter Power Interface Board | Pin Number | to | Pin Number | Converter Power Interface Board | Description |
|---|---|---|---|---|---|
| J8 | 1 | … | 11 | J6 | FB Bus |
| | 2 | … | 10 | | AD Gnd |
| | 3 | … | 9 | | AD Gnd |
| | 4 | … | 8 | | +5V |
| | 5 | … | 7 | | +5V |
| | 6 | … | 6 | | -12VDC |
| | 7 | … | 5 | | AD Gnd |
| | 8 | … | 4 | | +12V |
| | 9 | … | 3 | | 24V Com |
| | 10 | … | 2 | | +24VDC |
| | 11 | … | 1 | | 24V Fan |

## Voltage Feedback Harness

| Inverter Power Interface Board | Pin Number | to | Pin Number | Gate Board | Description |
|---|---|---|---|---|---|
| J7 | 1 | … | 1 | | +DC |
| | 2 | … | 2 | | — |
| | 3 | … | 3 | | — |
| | 4 | … | 4 | | -DC |
| | 5 | … | 5 | | -DC |
| | 6 | … | 6 | | 22V - ISO PWR |
| | 7 | … | 7 | | — |
| | 8 | … | 8 | | — |
| | 9 | … | 9 | | W |
| | 10 | … | 10 | | — |
| | 11 | … | 11 | | — |
| | 12 | … | 12 | | V |
| | 13 | … | 13 | | — |
| | 14 | … | 14 | | — |
| | 15 | … | 15 | | U |

## Motor Voltage Feedback PCB

| Motor Voltage Feedback PCB | Pin Number | to | Pin Number | Inverter Power Interface Board | Description |
|---|---|---|---|---|---|
| P3 | 1 | … | 1 | J11 | POS_BUS |
| | 2 | … | 2 | | — |
| | 3 | … | 3 | | — |
| | 4 | … | 4 | | WN_GATE (NC) |
| | 5 | … | 5 | | VN_GATE (NC) |
| | 6 | … | 6 | | UN_GATE (NC) |
| | 7 | … | 7 | | NEG_RTN |
| | 8 | … | 8 | | UVWN_EMIT |
| | 9 | … | 9 | | NEG_PWR (-DC) |
| | 10 | … | 10 | | BRAKE_GATE (NC) |
| | 11 | … | 11 | | — |
| | 12 | … | 12 | | — |
| | 13 | … | 13 | | W_POS_RTN (NC) |
| | 14 | … | 14 | | WP_EMIT |
| | 15 | … | 15 | | W_POS_PWR (NC) |
| | 16 | … | 16 | | WP_GATE (NC) |
| | 17 | … | 17 | | — |
| | 18 | … | 18 | | — |
| | 19 | … | 19 | | V_POS_RTN (NC) |
| | 20 | … | 20 | | VP_EMIT |
| | 21 | … | 21 | | V_POS_PWR (NC) |
| | 22 | … | 22 | | VP_GATE (NC) |
| | 23 | … | 23 | | — |
| | 24 | … | 24 | | — |
| | 25 | … | 25 | | U_POS_RTN (NC) |
| | 26 | … | 26 | | UP_EMIT |
| | 27 | … | 27 | | U_POS_PWR (NC) |
| | 28 | … | 28 | | UP_GATE (NC) |

## Converter Power Interface Board to Terminal Block

| Converter Power Interface Board | Pin Number | to | Pin Number | Terminal Block | Description |
|---|---|---|---|---|---|
| J3 | 1 | … | 1a-4 | TB1 | Temp Switch |
| | 2 | … | | | |
| | 3 | … | 1a-1 | | Precharge Aux |
| | 4 | … | 1a-3 | | +24V (digin) |
| | 5 | | | | |
| | 6 | | | | |
| | 7 | … | 1a-9 | | Precharge Coil |
| | 8 | … | 1a-11 | | 120V |

| Converter Power Interface Board | Pin Number | to | Pin Number | Terminal Block | Description |
|---|---|---|---|---|---|
| J2 | 1 | … | 1a-5 | TB1 | +12V from Cooling Loop |
| | 2 | … | 1a-6 | | Cooling Loop Return |
| | 3 | … | 1a-7 | | +24V (digin) |
| | 4 | … | 1a-8 | | Gate Enable |

## Converter Control Board to Power Supply and DC Bus

| Converter Control Board | Pin Number | to | Pin Number | Power Supply Board and DC Bus Resistor Connector | Description |
|---|---|---|---|---|---|
| J2 | 9 | … | 1a-12 | TB1 Terminal Block | Aux Out NO |
| | 10 | … | 1a-10 | | Aux Out Com |
| | 13 | … | 3 | M2-m - Male Signal | Safety HWEN |
| | 14 | … | 3 | | Aux In 24V |
| | 15 | … | 4 | | Aux In |

## Temperature Switches to Fan

| Temperature Switches | Pin Number | to | Pin Number | Fan Connector | Description |
|---|---|---|---|---|---|
| 3% Reactor Temp Sw | — | … | 1b-3 | TB1 | 3% Reactor Temp Sw |
| 9% Reactor Temp Sw | — | … | 1b-13 | | 9% Reactor Temp Sw |
| Converter Snubber Temp Sw | — | … | 1b-14 | | Converter Snubber Temp Sw |
| Inverter Snubber Temp Sw | — | … | 1b-15 | | Inverter Snubber Temp Sw |

| Power Section Stirring Fan | Pin Number | to | Pin Number | | Description |
|---|---|---|---|---|---|
| | E1-2 | … | PE-2 | TB1 | Fan Terminal 1 (Ground) |
| | F1-2 | … | 1b-12 | | Fan Terminal 2 |

## Power and Ground to Contactors and Voltage Feedback

| Male Power Connector | Pin Number | to | Pin Number | Terminal Block - TB1<br>Ground - PE2<br>Power - 3 Phase | Description |
|---|---|---|---|---|---|
| M1-m | 1 | … | 1b-9 | TB1 | Coil Terminal 1 on K2 Precharge Contactor |
| | 2 | … | 1b-10 | | Coil Terminal 1 on K1 Filter Contactor |
| | 3 | … | | | |
| | 4 | … | PE2 | PE2 | Ground |
| | 5 | … | PE2 | | Ground |
| | 6 | … | | | |
| | 7 | … | 7 | 3 Phase | T Phase |
| | 8 | … | 4 | | S Phase |
| | 9 | … | 1 | | R Phase |

| Female Power Connector | Pin Number | to | Pin Number | Filter Contactor - K1<br>Precharge Contactor - K2<br>Voltage Feedback PCB - P3 | Description |
|---|---|---|---|---|---|
| M1-f | 1 | … | A1 | K1 | Coil Terminal 1 |
| | 2 | … | A1 | K2 | Coil Terminal 1 |
| | 3 | … | | | |
| | 4 | … | A2 | K2 | Coil Terminal 2 |
| | 5 | … | A2 | K1 | Coil Terminal 2 |
| | 6 | … | | | |
| | 7 | … | 7 | P3 | T Phase |
| | 8 | … | 4 | | S Phase |
| | 9 | … | 1 | | R Phase |

## Control Transformer and Converter Control to Contactors

| Male Signal Connector | Pin Number | to | Pin Number | Control Transformer - T1 Converter Control Board - P1 Terminal Block - TB1 | Description |
|---|---|---|---|---|---|
| M2-m | 1 | ... | P1 | T1 | Primary In |
| | 2 | ... | P2 | | |
| | 3 | ... | 14 | P1 | Aux In 24V |
| | 4 | ... | 15 | | Aux In |
| | 5 | ... | 1b-1 | TB1 | Aux Cont 1 |
| | 6 | ... | 1b-2 | | Aux Cont 2 |

| Female Signal Connector | Pin Number | to | Pin Number | Filter Contactor - K1 Precharge Contactor - K2 | Description |
|---|---|---|---|---|---|
| M2-f | 1 | ... | | | T Phase |
| | 2 | ... | | | S Phase |
| | 3 | ... | 13 | K1 | Aux Cont 1 |
| | 4 | ... | 14 | | Aux Cont 2 |
| | 5 | ... | 13 | K2 | Aux Cont 1 |
| | 6 | ... | 14 | | Aux Cont 2 |

## Power Supply to Stirring Fan

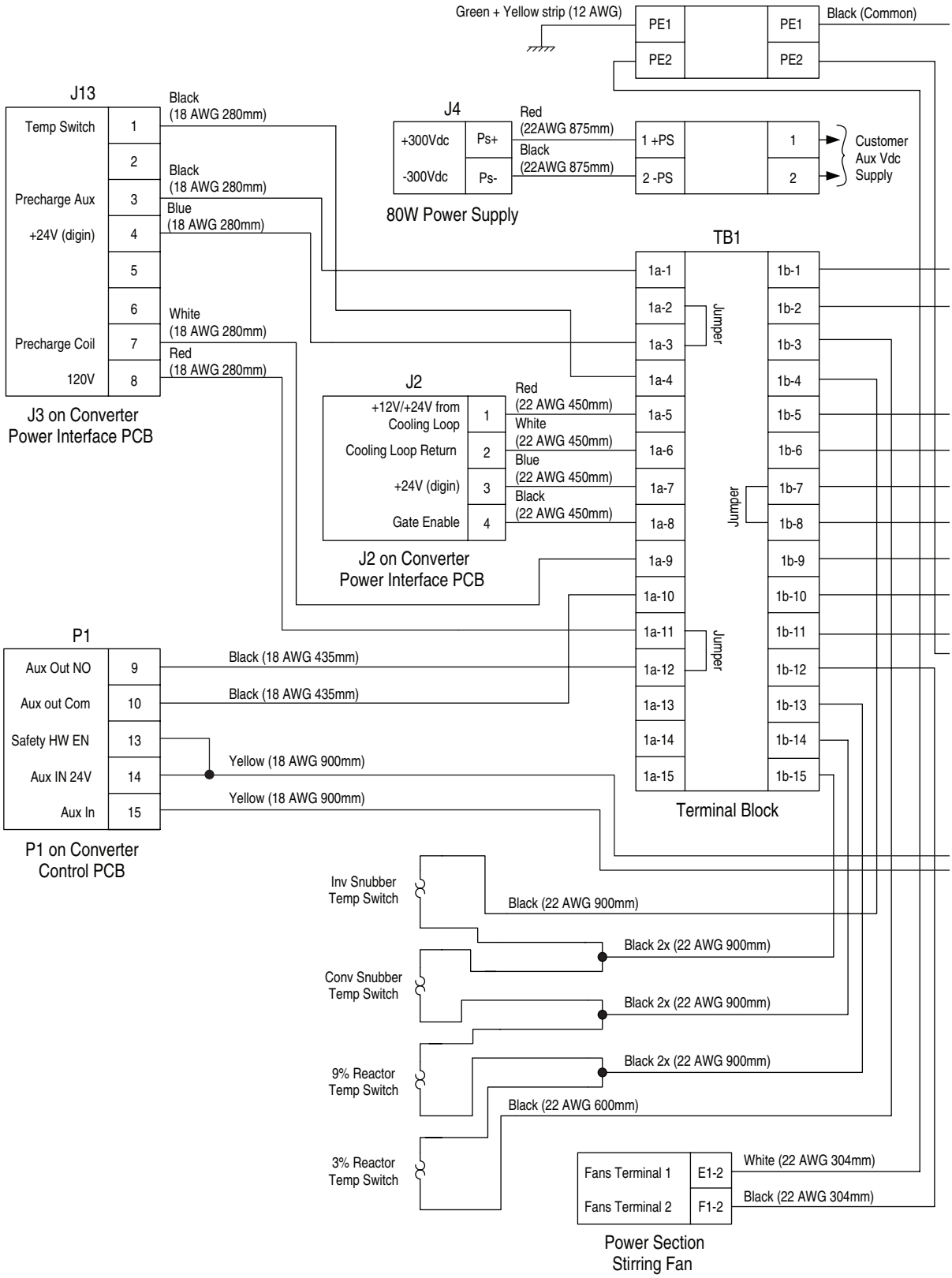
| 80W Power Supply | Pin Number | to | Pin Number | 2x Input Filter Stirring Fan | Description |
|---|---|---|---|---|---|
| J1 | 8 | ... | +24V | | Fan1 |
| | 7 | ... | Com | | Fan1/Fan2 |
| | 6 | ... | -24V | | Fan2 |

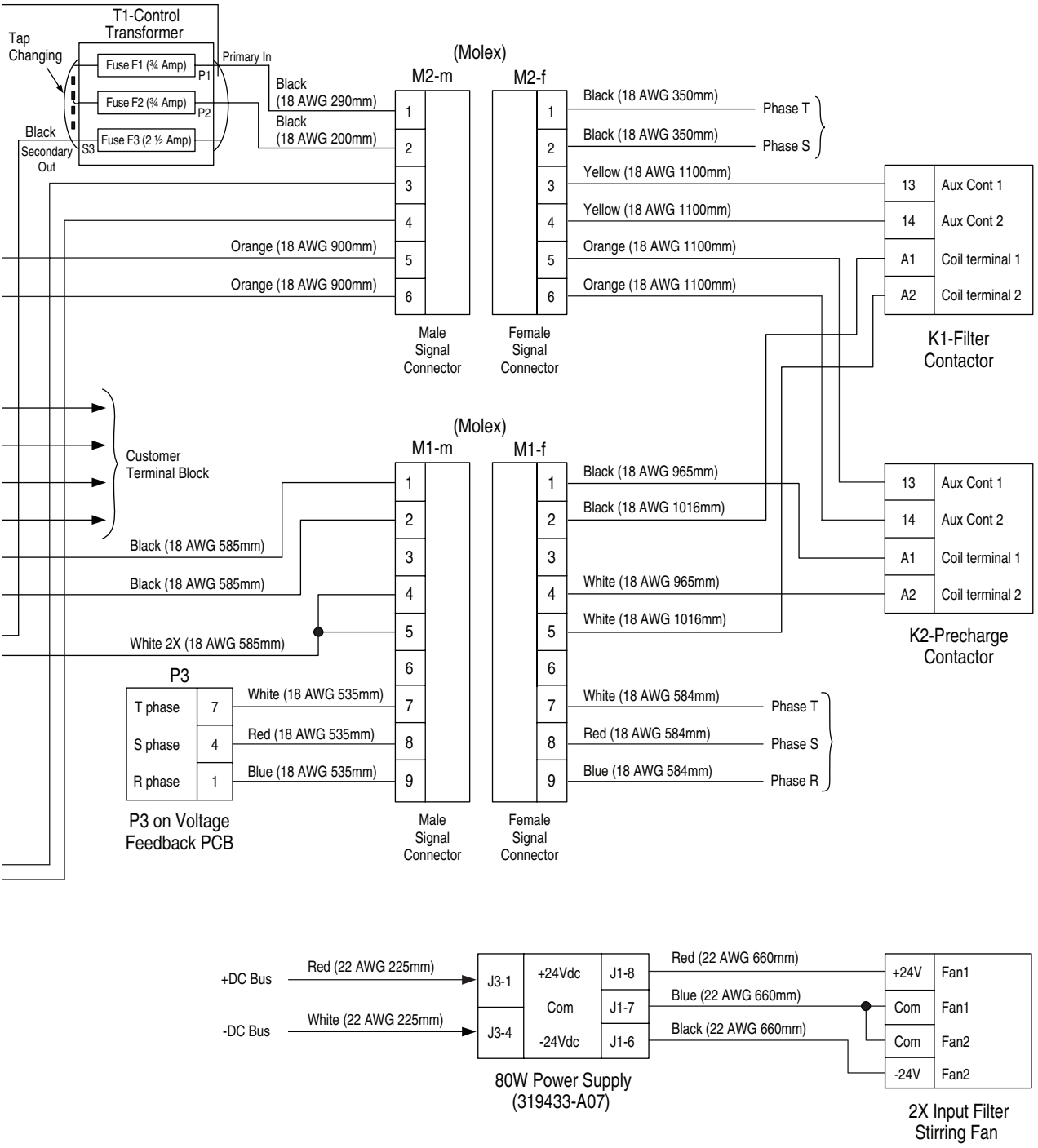
## Notes:

# Connection Diagram and Schematics

The connection diagram is shown on the following pages.

# Frame 2 Connection Diagram




T1-Control Transformer
Tap Changing
Fuse F1 (¾ Amp)
Fuse F2 (¾ Amp)
Fuse F3 (2 ½ Amp)
P1
P2
S3
Primary In
Black Secondary Out
Black (18 AWG 290mm)
Black (18 AWG 200mm)
(Molex)
M2-m
M2-f
Black (18 AWG 350mm)
Phase T
Black (18 AWG 350mm)
Phase S
Yellow (18 AWG 1100mm)
Yellow (18 AWG 1100mm)
Orange (18 AWG 900mm)
Orange (18 AWG 900mm)
Orange (18 AWG 1100mm)
Orange (18 AWG 1100mm)
Male Signal Connector
Female Signal Connector
13 Aux Cont 1
14 Aux Cont 2
A1 Coil terminal 1
A2 Coil terminal 2
K1-Filter Contactor
Customer Terminal Block
(Molex)
M1-m
M1-f
Black (18 AWG 965mm)
Black (18 AWG 1016mm)
Black (18 AWG 585mm)
Black (18 AWG 585mm)
White (18 AWG 965mm)
White (18 AWG 1016mm)
White 2X (18 AWG 585mm)
K2-Precharge Contactor
P3
T phase 7
S phase 4
R phase 1
White (18 AWG 535mm)
Red (18 AWG 535mm)
Blue (18 AWG 535mm)
White (18 AWG 584mm)
Red (18 AWG 584mm)
Blue (18 AWG 584mm)
Phase T
Phase S
Phase R
P3 on Voltage Feedback PCB
Male Signal Connector
Female Signal Connector
+DC Bus
-DC Bus
Red (22 AWG 225mm)
White (22 AWG 225mm)
J3-1
J3-4
+24Vdc
Com
-24Vdc
J1-8
J1-7
J1-6
80W Power Supply (319433-A07)
Red (22 AWG 660mm)
Blue (22 AWG 660mm)
Black (22 AWG 660mm)
+24V Fan1
Com Fan1
Com Fan2
-24V Fan2
2X Input Filter Stirring Fan

## Frame 2 Schematics

For PowerFlex 700L Frame 2 schematics, see the *PowerFlex 700L Liquid-Cooled Adjustable Frequency AC Drive User Manual* (publication 20L-UM001).

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